Can Headache Profile Predict Future Disability
A Cohort Study

Mariève Houle, MSc,* Andrée-Anne Marchand, PhD,† and Martin Descarreaux, PhD*†

Objective: The aim of this study was to determine if headache profile can predict future disability in patients with tension-type headache (TTH).

Materials and Methods: Eighty-three individuals with TTH were recruited. To be included in the study participants needed to fulfill the International Headache Society classification’s criteria for episodic or chronic TTH form and to be at least 18 years old. Baseline clinical outcomes (headache and neck-related disability, kinesiophobia, self-efficacy, and anxiety) and physical outcomes (neck extensors muscles maximum voluntary contraction) were collected for all participants. A prospective data collection of headache characteristics (intensity and frequency) was conducted using daily SMS or e-mail over a 1-month period. Headache-related disability was assessed at the 3-month follow-up and was used as the disability criterion for TTH.

Results: Correlations showed that the number of years with headache ($r = 0.53, P < 0.001$), self-reported neck pain intensity ($r = 0.29, P = 0.025$), headache frequency ($r = 0.60, P < 0.001$) and intensity ($r = 0.54, P < 0.001$), anxiety ($r = 0.28, P = 0.031$), as well as neck-related disability ($r = 0.64, P < 0.001$) were correlated to headache-related disability assessed at 3 months. Multiple regression showed that these determinants can be used to predict headache disability ($R^2 = 0.583$). Headache frequency ($\beta = 0.284$) was the best individual predictor.

Discussion: Results showed that TTH frequency and intensity and the presence of comorbid infrequent migraine are predictors of future disability over a 3-month period. Further studies are needed to evaluate the contribution of other potential physical outcomes on headache-related disability.

Key Words: tension-type headache, headache profile, neck pain, disability, strength

(Clin J Pain 2020;36:594–600)

Tension-type headache (TTH) is the most common type of headache1 with a lifetime prevalence in the general population that ranges between 30% and 78%.2–4 The average age of TTH onset is estimated between 25 and 30 years old with the peak prevalence for both sexes occurring between 30 and 39 years of age, followed by a decline with increasing age.1,5 Women are more affected than men with female:male ratios ranging from 1.3:1 to 5.4.1,3,6

According to the International Headache Society (IHS), TTH is classified as a primary headache3 and typically described by a bilateral, pressing, tightening and nonpulsating pain. In addition, intensity of TTH is considered to be mild to moderate without aggravation by routine physical activity such as climbing stairs or walking and is not associated with nausea or vomiting except for mild nausea that can be present in chronic tension-type headache (CTTH).5 Furthermore, phonophobia or photophobia can occur during TTH episodes, but both symptoms should not be present at the same time.3,5 TTH can be divided into 2 categories: episodic or chronic form. The episodic form is further divided into 2 subcategories based on the frequency of episodes: infrequent episodic tension-type headache (IETTH) or frequent episodic tension-type headache (FETTH).3 IETTH is characterized by at least 10 episodes occurring <1 day per month (<12 d/y), FETTH is characterized by 1 to 14 days per month for at least 3 consecutive months (>12 and <180 d/y) and CTTH consists of 15 days or more with headaches per month (>180 d/y) Table 1.1,3 In a Danish population-based study, the 1-year prevalence of each category at 40 years old was 48.2%, 33.8%, and 2.3%, respectively, and the prevalence was higher in men for the IETTH than in women but FETTH and CTTH was more frequent in women than in men.7 TTH and particularly CTTH are often associated with medical and psychiatric conditions. Indeed, TTH has previously been linked to common comorbidities such as temporomandibular disorders, depression, anxiety, and panic disorders.5 To date, only a few studies have evaluated risk factors for the development of TTH or risk factors that leads to a transition from episodic to chronic forms.5–10 In fact, environmental, genetic, and peripheral factors such as tenderness in pericranial muscles, muscle strain, muscle blood flow, and other central factors have all been hypothesized as possible contributors to the development of TTH.8 Moreover, risk factors to transition from the episodic TTH form to the chronic TTH form are divided into 2 categories: nonmodifiable risk factors and modifiable risk factors. On the one hand, nonmodifiable risk factors include increasing age, female sex, being white, previous history of head trauma and low socioeconomic status.9 On the other hand, modifiable risk factors include sleep disturbances, medication overuse, obesity, and the presence of psychological comorbidities.5 Depression and anxiety are common with TTH, especially in the chronic form.11 However, there are only few studies with follow-ups that have been conducted in adults with TTH. A study by Lyngberg and colleagues showed that, in adults randomly drawn from the general population, predictors of poor outcomes in patients with TTH were having FRTH or CTTH at baseline, having coexisting migraine, not being married and having sleep problems.12 In their study, no association was found with respect to age, sex, or educational levels.
Frequency and intensity of TTH are 2 factors frequently assessed in studies but are also used to define inclusion criteria for TTH participants (IETTH, FETTH, or CTTH group). Moreover, Sauro et al\textsuperscript{13} reported a positive correlation between intensity and headache-related disability as evaluated by the 6-item Headache Impact Test (HIT-6) questionnaire but failed to identify any correlations between frequency and headache-related disability in patients with headache including patients with TTH. In the general population, individuals with higher impact associated to TTH have a lower quality of life, are more frequently absent from work and have lower work performance.\textsuperscript{14} A Danish population-based study reported that absence rates were higher in individuals with FETTH than in headache-free participants.\textsuperscript{15} Headache-related disability assessed by the HIT-6 questionnaire appear to be an important aspect to monitor in TTH patients to evaluate changes over time and to guide futures clinical interventions. The aim of this study was to determine if headache profile can predict future disability in participants with TTH.

**MATERIALS AND METHODS**

**Study Design**

This cohort study was conducted at the Laboratory of Motor Control and Neuromechanics located at the University of Québec in Trois-Rivières. Recruitment, testing, and follow-up were conducted from August 2016 to November 2017. This study falls within the continuity of a study with controls and TTH participants (Marchand et al\textsuperscript{16} in press in *BMJ*).

**Participants’ Selection**

Eighty-three participants with TTH were recruited via social media platforms and from the university community. To be included in the study, participants needed to fulfill the IHS classification criteria for IETTH, FETTH, or CTTH (Table 1). Participants with concomitant headache and neck pain were included only if neck pain was not the dominant pain perceived. For participants experiencing other concomitant headache type, presentation, and symptoms of TTH were discussed at baseline and only patients for which TTH was the main headache type were included. Participants with concomitant migraine were included only if their episodes were infrequent. Distinction between headaches types were clearly highlighted at baseline as the goal of the study was to track only information related to TTH over the study period. However, participants were asked to report when they were affected by another headache type during the follow-up period. Exclusion criteria included a recent history of cervical spine trauma, recent whiplash, neck fracture, surgery or malignant lesion, infection, medication overuse, a diagnosis of fibromyalgia and having neurological deficits, spasmodic torticollis, presence of upper limb pain or lack of TTH episodes. Participants with neck, head, or shoulder pain due to an injury were excluded from this study as well as participants with all forms of pain whose frequency and intensity could interfere with headaches. Participants were not allowed to participate if they were under a course of treatment for headache TTH or for neck pain. Pregnant women were also excluded from the experimentation because of the prone position adopted during the neck extension task.

This study was approved by the University’s Research Ethic Committee for human participants (CER-16-225-07.15). All participants provided informed written consent before their participation in the study.

**Procedures**

The first session began with a brief history taking to obtain demographic data as well as information regarding typical episodes of TTH and neck pain over the last month. Headache and neck pain maximum and mean intensities were measured using a 10 cm visual analogue scale (VAS). Participants were inquired about frequency of headache and neck pain episodes over the past month. All clinical and physical outcomes were obtained at baseline. In addition, headache frequency and intensity were monitored daily for 30 days and 2 self-reported questionnaires (HIT-6 and Neck Disability Index [NDI]) were completed electronically using an online survey at the 1- and 3-month follow-ups (Fig. 1).

---

**TABLE 1.** International Headache Society (IHS) Classification Criteria for Infrequent Episodic Tension-type Headache, Frequent Episodic Tension-type Headache, and Chronic Tension-type Headache

| Infrequent Episodic Tension-type Headache | Frequent Episodic Tension-type Headache | Chronic Tension-type Headache |
|------------------------------------------|----------------------------------------|-------------------------------|
| A. At least 10 episodes of headache occurring on < 11 d/mo on average (< 12 d/mo) and fulfilling criteria B-D | A. At least 10 episodes of headache occurring on 1-14 d/mo on average for >3 mo (≥12 and <180 d/mo) and fulfilling criteria B-D | A. Headache occurring on ≥15 d/mo on average for >3 mo (≥180 d/ym) and fulfilling criteria B-D |
| B. Lasting from 30 min to 7 d | B. Lasting from 30 min to 7 d | B. Lasting hours to days, or unremitting |
| C. At least 2 of the following 4 characteristics: 1. Bilateral location 2. Pressing or tightening (nonpulsating) quality 3. Mild or moderate intensity 4. Not aggravated by routine physical activity such as walking or climbing stairs | C. At least 2 of the following 4 characteristics: 1. Bilateral location 2. Pressing or tightening (nonpulsating) quality 3. Mild or moderate intensity 4. Not aggravated by routine physical activity such as walking or climbing stairs | C. At least 2 of the following 4 characteristics: 1. Bilateral location 2. Pressing or tightening (nonpulsating) quality 3. Mild or moderate intensity 4. Not aggravated by routine physical activity such as walking or climbing stairs |
| D. Both of the following: 1. No nausea or vomiting 2. No more than one of photophobia or phonophobia | D. Both of the following: 1. No nausea or vomiting 2. No more than one of photophobia or phonophobia | D. Both of the following: 1. No more than one of photophobia, phonophobia or mild nausea 2. Neither moderate or severe nausea nor vomiting |
Clinical Outcomes

HIT-6

The validated French version of HIT-6 questionnaire was used to assess disability related to headaches.17 The HIT-6 is a 6-item, retrospective and self-reported questionnaire. This questionnaire addresses several quality of life components of such as pain, cognitive functioning, role functioning, vitality, social functioning, and psychological distress.13,18 Participants were asked to complete the questionnaire based on the past 4 weeks.13 The total score obtained was calculated by adding scores from each question for a maximum of 78 points.13 Higher scores reveal greater headache-related disability.

NDI

The validated French version of NDI was used to evaluate disability related to neck pain.19 This is a 10-item questionnaire related to cervical pain and the impact on everyday life as, for example, pain intensity, headache, concentration, reading, driving, and work.20 The total score obtained was calculated by adding scores from each question for a maximum of 50 points and higher scores reveal greater neck-related disability.19

Kinesiophobia, Anxiety, and Self-efficacy

At baseline, participants were asked to complete 3 other questionnaires related to kinesiophobia, anxiety, and self-efficacy. Kinesiophobia was assessed using the validated French version of the Tampa Scale of Kinesiophobia a 17-items questionnaire that allows quantification of fear of movement with higher score reflecting an increased level of kinesiophobia.21 To assess anxiety, the validated French-Canadian version of the state trait anxiety inventory (STAI-Y) was used.22 This 20-item questionnaire evaluates anxiety as a personality trait and anxiety as an emotional state related to a particular situation.22 Finally, self-efficacy was assessed by the validated French general self-efficacy scale (GSE) that evaluates individuals perception to meet the needs of tasks in different contexts.23,24

30-Day Data Collection

On a daily basis, participants were asked for 30 days about the presence and intensity of headaches within the last 24 hours. If any, they were invited to identify the type of headache they had (TTH or migraine for participants known to have concomitant types of headache). On the basis of participants’ preferences, they were contacted by e-mails (5) or text messages (43) and some people (11) preferred to complete a headache diary.

Physical Outcomes

Maximum voluntary contraction (MVC) of neck extensor muscles was tested in a prone position on a table with the participant’s head and the neck past the edge of the table. To ensure minimal recruitment of thoracic and scapular muscles, the cervicothoracic junction was stabilized with a strap (Fig. 2). To evaluate the strength of the neck extensor muscles, another strap was disposed over the protuberancia occipitalis and was anchored to the floor. The head strap was adjusted to ensure that participants’ head was stabilized in neutral horizontal position throughout testing. Participants were then asked to perform 3 neck extensors MVC while keeping the neutral horizontal position of the neck and the head. To perform the neck extensors MVC, participants were asked to progressively increase muscle contraction until maximum, hold the maximum for 3 to 5 seconds and then release. MVCs were recorded using a force gauge (Model IPM250; Futek Advanced Sensor Technology Inc., Irvine, CA). The first trial was performed to familiarized participants with the isometric extension contraction and a further 2 trials were conducted after the familiarization task. Each trial was followed by a period of rest of 1 minute.

FIGURE 1. Timeline of clinical and physical outcomes. GSE indicates general self-efficacy scale; HIT-6, 6-item headache impact test; NDI, Neck Disability Index; TSK, Tampa Scale of Kinesiophobia; TTH, tension-type headache.

FIGURE 2. Participants position during the evaluation of neck extensor maximal isometric strength.
Data and Statistical Analyses

Statistical analyses were performed using STATISTICA statistical package version 10 (Statsoft, Tulsa, OK), and the level of significance was set at P-value <0.05. Because of the asymmetrical data distribution (skewness) of several variables, data were normalized whenever it was deemed necessary using log-transformation. Self-reported headache frequency and intensity were compared with the data obtained from the 30-day daily monitoring using dependent t tests to assess participants’ ability to estimate their headache characteristics. Repeated analysis of variance were performed for HIT-6 and NDI questionnaires to assess the evolution of participants’ headache and neck-related disabilities and Tukey post hoc tests were performed to identify significant differences between baseline, the 1-month and the 3-month follow-up for HIT-6 and NDI. Correlations between headache frequency, headache intensity, neck pain frequency, neck pain intensity, kinesiophobia, anxiety, self-efficacy, neck-related disability, and headache-related disability at the 3-month follow-up were evaluated using the Pearson correlation coefficient. Multiple regressions analysis were conducted using the highest correlations value between all determinants and HIT-6 questionnaire at the 3-month follow-up to test if any variables predicted future headache-related disability over a 3-month period. Significant correlated determinants were added into the stepwise regression model and determinants that significantly contributed to headache-related disability over a 3-month period were identify.

RESULTS

Eighty-three participants were included at baseline. Twelve participants were lost at the 1-month follow-up and 8 others were lost at the 3-month follow-up because participants did not return the questionnaires (Fig. 3). Before excluding a participant, a reminder was sent on 3 different occasions to any participant who did not return their questionnaires. A total of 59 participants were included in the analysis. Three participants had concomitant infrequent migraine.

Baseline Demographics

Means scores and SDs were calculated for all clinical and physical baseline outcomes (Table 2). Participants presented with low fear of movement (27.80 ± 5.86) and anxiety (35.64 ± 9.47) mean scores and a high self-efficacy mean score (35.42 ± 3.24). The mean score for headache-related disability indicated moderate headache impact (score ≥ 50 points for the HIT-6 questionnaire).

Frequency and Intensity of Headache

$t$ test for dependent samples comparing self-reported frequency (mean = 6.58; SD = 8.06) and frequency assess at 30 days (7.75; SD = 6.69) revealed no significant difference between self-reported headache frequency and 30 days data collection (P = 0.107). However, there was a significant difference (P < 0.001) between self-reported headache intensity (mean = 3.93; SD = 1.77) and headache intensity obtained from the 30-day data collection (mean = 2.97; SD = 1.51) (see Table 2 for self-reported data and Table 3 for 30 d data collection).

HIT-6 and NDI Score Evolution

The analysis of variance indicated a significant effect of time on headache-related disability ($F_{2.116} = 4.53$, $P = 0.013$) and a significant effect of time on neck-related disability ($F_{2.116} = 4.89$, $P = 0.009$). Tukey post hoc test showed a significant decrease in headache-related disability between baseline and the 1-month follow-up (P = 0.036) and between baseline and the 3-month follow-up (P = 0.021) (Fig. 4) and showed a significant diminution in neck-related disability between baseline and the 3-month follow-up (P = 0.007) (Fig. 5).

TABLE 2. Participant’s Baseline Results for Clinical and Physical Outcomes

| Variables                        | Mean  | SD       |
|----------------------------------|-------|----------|
| Demographics                     |       |          |
| Age (y)                          | 27.88 | 9.41     |
| Female:male                      | 40:19 | NA       |
| Weight (kg)                      | 67.72 | 14.12    |
| Height (m)                       | 1.67  | 0.09     |
| BMI (kg/m²)                      | 24.18 | 4.10     |
| Years with headache              | 6.22  | 6.55     |
| Kinesiophobia (17-68)            | 27.80 | 5.86     |
| Self-efficacy (10-40)            | 35.42 | 3.24     |
| Anxiety (20-80)                  | 35.64 | 9.47     |
| Headache                         |       |          |
| Self-reported frequency of headache (previous month) | 6.58 | 8.06 |
| Self-reported mean intensity of headache (/10) | 3.93 | 1.77 |
| HIT-6 (36-78)                    | 51.17 | 9.31     |
| Neck pain                        |       |          |
| Self-reported frequency of neck pain (previous month) | 5.97 | 8.15 |
| Self-reported mean intensity of neck pain (/10) | 2.58 | 1.89 |
| NDI (/50)                        | 5.52  | 4.99     |
| Strength task MVC (N)            | 97.57 | 34.86    |

BMI indicates body mass index; HIT-6, 6-item headache impact test; MVC, maximum voluntary contraction; NDI, Neck Disability Index.

TABLE 3. Participant’s Results Regarding Frequency and Intensity of Headache for the 30-Day Data Collection

| Variables                        | Mean  | SD       |
|----------------------------------|-------|----------|
| Frequency of headache (/30 d)    | 7.75  | 6.84     |
| Intensity (/10)                  | 2.97  | 1.51     |
Predictors of Headache-related Disability at 3 Months

High correlations were found between self-reported headache frequency, self-reported headache intensity and HIT-6 score at the 3-month follow-up. However, self-reported headache frequency and intensity were excluded from the multiple regression because frequency and intensity were also prospectively collected for 30 days and were considered more specific than self-reported data estimated at baseline considering the past month. Self-reported neck pain frequency, kinesiophobia, and self-efficacy were also excluded because they did not correlate with HIT-6 at 3 months nor with any other outcome measures (Table 4). The number of years with TTH (r = 0.53, P = 0.001), self-reported neck pain intensity (r = 0.29, P = 0.025), headache frequency (r = 0.60, P < 0.001), headache intensity (r = 0.54, P < 0.001), anxiety (r = 0.28, P = 0.031), as well as neck-related disability at baseline (r = 0.64, P < 0.001) were included in the multiple regression model because of their high correlation with the HIT-6 score at 3 months. Presence of comitant infrequent migraine was added as a covarible to the multiple regression model given that migraine is known to be a predictor of poor outcome in TTH.12 Number of years with TTH, self-reported neck pain intensity, anxiety, and neck-related disability at baseline were highly correlated with headache-related disability at 3-month. However, in the stepwise regression model, none of them remained significantly associated with headache-related disability at 3-month (P = 0.460, 0.508, 0.304, and 0.112, respectively). Results showed that headache frequency, headache intensity, and the presence of comitant infrequent migraine were good predictors of headache-related disability at 3 months. Altogether, predictors were able to predict 58.3% of the headache-related disability variance. Results of the regression model are presented in Table 5.

**DISCUSSION**

The purpose of this study was to determine if headache profile can predict future disability in participants with TTH. Participants’ mean age was 27.88 ± 9.41 years which is consistent with the age group with the highest TTH prevalence in the literature (25 to 30 y old). The results showed that 30 days mean headache frequency and intensity as well as self-reported mean intensity of neck pain anxiety, years

![FIGURE 4](https://www.clinicalpain.com/ClinJ%20Pain%20Volume%2036%20Number%208%20August%202020/image1.png)

**FIGURE 4.** 6-item headache impact test (HIT-6) score evolution from baseline to the 3-month follow-up in tension-type headache participants. *P = 0.025, **P = 0.017.

![FIGURE 5](https://www.clinicalpain.com/ClinJ%20Pain%20Volume%2036%20Number%208%20August%202020/image2.png)

**FIGURE 5.** Neck Disability Index (NDI) score evolution from baseline to the 3-month follow-up in tension-type headache participants. *P = 0.007.

**TABLE 4. Correlations Between Determinants and Headache-related Disability**

| Variables                  | Correlation Coefficient (r) | P     |
|----------------------------|-----------------------------|-------|
| Baseline                   |                             |       |
| MVC of neck extensors      | -0.16                       | 0.236 |
| Years with headache        | 0.53                        | < 0.001 |
| Self-reported headache frequency | 0.52                    | < 0.001 |
| Self-reported headache intensity | 0.61                   | < 0.001 |
| Self-reported neck pain frequency | 0.21                  | 0.115 |
| Self-reported neck pain intensity | 0.29                   | 0.025 |
| Kinesiophobia              | -0.009                      | 0.945 |
| Anxiety                    | 0.28                        | 0.031 |
| Self-efficacy              | -0.10                       | 0.437 |
| HIT-6                      | 0.72                        | < 0.001 |
| NDI                        | 0.64                        | < 0.001 |
| 30 d data collection       |                             |       |
| Headache frequency         | 0.60                        | < 0.001 |
| Headache intensity         | 0.54                        | < 0.001 |
| 1 mo follow-up             |                             |       |
| HIT-6                      | 0.86                        | < 0.001 |
| NDI                        | 0.65                        | < 0.001 |

HIT-6 indicates 6-item headache impact test; MVC, maximal voluntary contraction; NDI, Neck Disability Index.

**TABLE 5. Predictors of Headache-related Disability**

| Variables                  | β     | P     |
|----------------------------|-------|-------|
| Years with headaches       | 0.087 | 0.460 |
| Self-reported neck pain intensity | -0.073   | 0.508 |
| Headache frequency in 30 d | 0.284 | 0.032 |
| Headache intensity in 30 d | 0.253 | 0.024 |
| Anxiety                    | 0.100 | 0.304 |
| Neck Disability Index (baseline) | 0.245   | 0.112 |
| Presence of concomitant migraine | 0.206    | 0.044 |

Multiple regression: R² = 0.583
with TTH, neck-related disability and presence of concomitant infrequent migraine can predict future disability in patients with TTH.

Headaches Characteristics

With regards to participants’ headache characteristics, the results showed a high correlation between the number of years with TTH and headache-related disability and between number of TTH episodes in a month and headache-related disability as well as a moderate correlation between TTH intensity and headache-related disability. Mild to moderate pain intensity represents the clinical criteria required in the diagnosis of TTH and based on the present results moderate intensity had a higher impact on headache-related disability. Multiple regressions showed that intensity is an important predictor of future disability, but headache frequency was the most important predictive factor of headache-related disability. These results are in accordance with a previous study which showed that frequent headache categories (FETTH and CTTH) are associated with higher headache-related impact than the infrequent headache category. Kim et al also reported an increased burden of headache-related disability associated with the chronic form compared with infrequent and frequent episodic forms. TTH patients seem to be more affected by the number of headache episodes than by their intensity. Experiencing TTH on a regular basis seems to influence psychological wellbeing. In fact, frequent headache and disability seem to impair quality of life. Headache intensity contributes to occasional disability in a month or in a year while a higher number of headaches in a month can contribute to higher disability. A previous study showed the impact of ETTH and CTTH and their contribution to absenteeism and presenteeism in TTH patients.

Neck Pain and Neck Extensor Muscle Strength

In the current study, neck pain and neck extensor muscle MVC were assessed because neck pain has been traditionally linked with TTH and neck pain has been shown to be more prevalent in TTH patients than in individuals with no TTH. Neck pain has previously been associated with decreased neck muscle strength. The present study did not reveal any correlation between neck extensor muscle strength and headache-related disability. In addition, neck muscle strength was not retained among predictive factors of future headache-related disability. However, results showed that concomitant neck pain was present in TTH patients with a self-reported mean of 5.97 days. Results also showed that neck pain intensity was correlated with a higher score in HIT-6 at the 3-month follow-up (r = 0.29) and that it can be considered as a predictive determinant of future disability. Ashina et al found a correlation between neck pain frequency and the frequency of TTH and suggested a possible shared pathophysiological mechanism between neck pain and primary headache including TTH. Regarding neck extensor muscle strength, previous studies showed a decrease in neck extensor muscle force production in TTH patients compared with healthy controls. However, our results showed that MVC is not a physical determinant of future disability as evaluated by the HIT-6 questionnaire.

HIT-6 and NDI

Findings of the present study indicated statistically significant decreases in headache-related disability and neck-related disability over the 3-month follow-up period but these differences were not clinically significant. To be considered clinically significant, the minimally clinical important change in TTH related disability should reach 8 points on the HIT-6 score. The results of the present study showed a decrease of only 2.07 points on the HIT-6 mean score between baseline and the 3-month follow-up. Regarding the neck disability, a difference of 3.5 points on the NDI scale represents the minimally clinical important change and the present results indicated a decrease of 1.21 points between the baseline and 3-month scores therefore not reaching the threshold for neck-related disability minimally clinically important change. The decrease for HIT-6 and NDI scores found in the present study can be explained by the natural fluctuation of TTH over time. Indeed, prognostic factors of TTH recovery are less severe headache, mild headache-related disability, not using medication, absence of anxiety, sleep problem, depression, or other pain.

Kinesiophobia, Anxiety, and Self-efficacy

The results showed low levels of kinesiophobia and high self-efficacy scores and these scores were not correlated to any of the clinical or physical outcomes. The current results showed that anxiety was correlated with headache-related disability. Anxiety has been extensively explored in TTH and some studies found that anxiety seemed to be more dependent on the TTH frequency which means that CTTH patients would be more anxious than ETTH patients. Results of the present study are consistent with these previous findings.

Limitations

This study is not without limitations. Indeed, baseline neck pain frequency and intensity were self-reported by participants based on episodes over the past month, which could have been influenced by recollection bias. Although the comparison between retrospective and prospective self-reported data showed that participants were able to correctly estimate headache frequency, they overestimated headache intensity, which could also have been overestimated in self-reported neck pain intensity. In addition, in the present study, TTH participants results were analyzed without considering TTH categories (infrequent episodic, frequent episodic, and chronic), and it should be kept in mind that results could differ between the episodic forms and the chronic form. Another limitation is our small number of participants, thus the results should be interpreted with caution.

Results of the present study showed that TTH frequency and intensity, and the presence of concomitant infrequent migraine are predictors of future disability over a 3-month period. Results also showed that neck extensor muscles strength was not correlated with headache-related disability or with any other clinical outcomes and was not a good predictor of future disability. Further studies are needed to evaluate the predictive value of other physical outcomes on headache-related disability. TTH constitutes a major public health problem and a better understanding of clinical and physical factors is needed. Health professionals should consider clinical outcomes to evaluate and elaborate future treatment strategies for patients with TTH.
REFERENCES

1. Jensen RH. Tension-type headache—the normal and most prevalent headache. *Headache*. 2018;58:339–345.
2. Jensen R, Stovner LJ. Epidemiology and comorbidity of headache. *Lancet Neurol*. 2008;7:354–361.
3. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia*. 2013;33:629–808.
4. Marchand AA, Houle M, Girard MP, et al. Epidemiology of headache in a general population—a prevalence study. *J Clin Epidemiol*. 1991;44:1147–1157.
5. Crystal SC, Robbins MS. Epidemiology of tension-type headache. *Curr Pain Headache Rep*. 2010;14:449–454.
6. Schwaiger J, Kiechl S, Seppi K, et al. Prevalence of primary headaches and cranial neuralgias in men and women aged 55–94 years (Bruneck Study). *Cephalalgia*. 2009;29:179–187.
7. Russell MB. Tension-type headache in 40-year-olds: a Danish population-based sample of 4000. *J Head Pain*. 2005;6:441–447.
8. Ashina S, Bendtsen L, Ashina M. Pathophysiology of tension-type headache. *Curr Pain Headache Rep*. 2005;9:415–422.
9. Ashina S, Lyngberg A, Jensen R. Headache characteristics and chronification of migraine and tension-type headache: a population-based study. *Cephalalgia*. 2010;30:943–952.
10. Hagen K, Asberg AN, Stovner L, et al. Lifestyle factors and risk of migraine and tension-type headache. Follow-up data from the Nord-Trøndelag Health Surveys 1995-1997 and 2006-2008. *Cephalalgia*. 2018;38:1919–1926.
11. Juang KD, Wang SJ, Fuh JL, et al. Comorbidity of depressive and anxiety disorders in chronic daily headache and its subtypes. *Headache*. 2000;40:818–823.
12. Lyngberg AC, Rasmussen BK, Jorgensen T, et al. Prognosis of migraine and tension-type headache: a population-based follow-up study. *Neurology*. 2005;65:580–585.
13. Sauro KM, Rose MS, Becker WJ, et al. HIT-6 and MIDAS as measures of headache disability in a headache referral population. *Headache*. 2010;50:383–395.
14. Jensen R. Diagnosis, epidemiology, and impact of tension-type headache. *Curr Pain Headache Rep*. 2003;7:455–459.
15. Lyngberg AC, Rasmussen BK, Jorgensen T, et al. Secular changes in health care utilization and work absence for migraine and tension-type headache: a population based study. *Eur J Epidemiol*. 2005;20:1007–1014.
16. Marchand AA, Houle M, Girard MP, et al. Comparing neck extensor muscle function in asymptomatic Canadian adults and adults with tension-type headache: a cross-sectional study. *BMJ Open*. 2019;9:e029984.
17. Magnoux E, Freeman MA, Zlotnik G. MIDAS and HIT-6: French translation: reliability and correlation between tests. *Cephalalgia*. 2008;28:26–34.
18. Castien RF, Blankenstein AH, Windt DAVID, et al. Minimal clinically important change on the Headache Impact Test-6 questionnaire in patients with chronic tension-type headache. *Cephalalgia*. 2012;32:710–714.
19. Wlodryka-Demaille S, Poiraudreau S, Catanzariti JF, et al. French translation and validation of 3 functional disability scales for neck pain. *Arch Phys Med Rehabil*. 2002;83:376–382.
20. Macdermid JC, Walton DM, Avery S, et al. Measurement properties of the Neck Disability Index: a systematic review. *J Orthop Sports Phys Ther*. 2009;39:408–417.
21. French DJ, France CR, Vigneau F, et al. Fear of movement/re-injury in chronic pain: a psychometric assessment of the original English version of the Tampa Scale for Kinesiophobia (TSK). *Pain*. 2007;127:42–51.
22. Gauthier J, Bouchard S. Adaptation canadienne française de la forme révisée du State Trait Anxiety Inventory de Spielberger [A French-Canadian adaptation of the revised version of Spielberger’s State–Trait Anxiety Inventory]. *Can J Behav Sci*. 1993;25:559–578.
23. Scholz U, Dottia BG, Sud S, et al. Is general self-efficacy a universal construct? Psychometric findings from 25 countries. *J Psychol*. 2002;18:242.
24. Chen G, Gully SM, Eden D. Validation of a new general self-efficacy scale. *Organizational Research Methods*. 2001;4:62–83.
25. Fumal A, Schoenen J. Tension-type headache: current research and clinical management. *Lancet Neurol*. 2008;7:70–83.
26. Kim B-S, Chung CS, Chu MK, et al. Factors associated with disability and impact of tension-type headache: findings of the Korean headache survey. *J Headache Pain*. 2015;16:40.
27. Cassidy EM, Tomkins E, Hardman O, et al. Factors associated with burden of primary headache in a specialty clinic. *Headache*. 2003;43:638–644.
28. Marcus DA. Identification of patients with headache at risk of psychological distress. *Headache*. 2000;40:373–376.
29. Robbins MS, Lipton RB. The epidemiology of primary headache disorders. *Semin Neurol*. 2010;30:107–119.
30. Marcus DA, Scharff L, Mercer S, et al. Musculoskeletal abnormalities in chronic headache: a controlled comparison of headache diagnostic groups. *Headache*. 1999;39:21–27.
31. Sohn J, Choi HC, Lee SM, et al. Differences in cervical musculoskeletal impairment between episodic and chronic tension-type headache. *Cephalalgia*. 2010;30:1514–1523.
32. Ashina S, Bendtsen L, Lyngberg AC, et al. Prevalence of neck pain in migraine and tension-type headache: a population study. *Cephalalgia*. 2015;35:211–219.
33. Scheuer R, Friedrich M. Reliability of isometric strength measurements in trunk and neck region: patients with chronic neck pain compared with pain-free persons. *Arch Phys Med Rehabil*. 2010;91:1878–1883.
34. Madsen BK, Sogaard K, Andersen LL, et al. Neck and shoulder muscle strength in patients with tension-type headache: a case-control study. *Cephalalgia*. 2016;36:29–36.
35. Madsen BK, Sogaard K, Andersen LL, et al. Neck/shoulder function in tension-type headache patients and the effect of strength training. *J Pain Res*. 2018;11:445–454.
36. Pool JJ, Ostelo RW, Hoving JL, et al. Minimal clinically important change of the Neck Disability Index and the Numerical Rating Scale for patients with neck pain. *Spine*. 2007;32:3047–3051.
37. Boardman H, Thomas E, Millson DS, et al. The natural history of headache: predictors of onset and recovery. *Cephalalgia*. 2006;26:1080–1088.
38. Peña-Velasco-Puente C, Fernández-de-las-Peñas C, González-Gutierrez JL, et al. Interaction between anxiety, depression, quality of life and clinical parameters in chronic tension-type headache. *Eur J Pain*. 2008;12:886–894.
39. Song T-J, Cho SJ, Kim W-J, et al. Anxiety and depression in tension-type headache: a population based study. *PLoS One*. 2016;11:e0165316.