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Papers

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Abstract

Objective To investigate the effectiveness of acupuncture compared with minimal acupuncture and with no acupuncture in patients with tension-type headache.
Design Three armed randomised controlled multicentre trial.
Setting 28 outpatient centres in Germany.
Participants 270 patients (74% women, mean age 43 (SD 13) years) with episodic or chronic tension-type headache.
Interventions Acupuncture, minimal acupuncture (superficial needling at non-acupuncture points), or waiting list control. Acupuncture and minimal acupuncture were administered by specialised physicians and consisted of 12 sessions per patient over eight weeks.
Main outcome measure Difference in numbers of days with headache between the four weeks before randomisation and weeks 9-12 after randomisation, as recorded by participants in headache diaries.
Results The number of days with headache decreased by 7.2 (SD 6.5) days in the acupuncture group compared with 6.6 (SD 6.0) days in the minimal acupuncture group and 1.5 (SD 3.7) days in the waiting list group (difference: acupuncture *v* minimal acupuncture, 0.6 days, 95% confidence interval −1.5 to 2.6 days, $P = 0.58$; acupuncture *v* waiting list, 5.7 days, 3.9 to 7.5 days, $P < 0.001$). The proportion of responders (at least 50% reduction in days with headache) was 46% in the acupuncture group, 35% in the minimal acupuncture group, and 4% in the waiting list group.
Conclusions The acupuncture intervention investigated in this trial was more effective than no treatment but not significantly more effective than minimal acupuncture for the treatment of tension-type headache.
Trial registration number ISRCTN9737659.

Introduction

Tension-type headache is essentially defined as bilateral headache of a pressing or tightening quality without a known medical cause.[1] Tension-type headache is classified as episodic if it occurs on less than 15 days a month and as chronic if it occurs more often.[1] A survey from the United States found a one year prevalence of 38% for episodic tension-type headache and 2% for chronic tension-type headache.[2] Acupuncture is widely used for the treatment of tension-type headache, but its effectiveness is controversial.[3] In the acupuncture randomised trial in tension-type headache (ART-TTH), we investigated whether acupuncture reduced the frequency of headache more effectively than did minimal acupuncture (superficial needling at non-acupuncture points) or no acupuncture in patients with tension-type headache.

Methods

Protocol, design, and randomisation

ART-TTH was a randomised multicentre trial comparing acupuncture, minimal acupuncture, and a no acupuncture waiting list condition. Minimal acupuncture served as a sham intervention; we included the additional no acupuncture waiting list control because minimal acupuncture is not a physiologically inert placebo. Patients were blinded to treatment in the acupuncture and minimal acupuncture arms of the study. Two blinded evaluators analysed headache diaries. The methods of the trial have been described in detail elsewhere.[4]

After a baseline phase of four weeks, we used a centralised telephone randomisation procedure (random list generated with sample size 2.0 by the statistician) to randomise patients, stratified by centre (block size 12 unknown to trial physicians), in a 2:1:1 ratio (acupuncture:minimal acupuncture:waiting list). We used the 2:1:1 ratio to facilitate recruitment and increase the compliance of trial physicians. All study participants provided written, informed consent, and the study conformed to common guidelines for clinical trials (Declaration of Helsinki, ICH-GCP, including certification by external audit).

Participants

Inclusion criteria were a diagnosis of episodic or chronic tension-type headache according to the criteria of the International Headache Society,[1] at least eight days with headache a month in the previous three months and in the baseline period, age 18-65 years, duration of symptoms at least 12 months, completed baseline headache diary, and written informed consent. Main exclusion criteria were additional migraine headache, secondary headaches, start of headaches after age 50, use of analgesics on more than 10 days a month, prophylactic headache treatment with drugs during the previous four weeks, and any acupuncture treatment during the previous 12 months or at any time if done by the participating trial physician. Most participants were recruited through reports in local newspapers; a minority were patients who spontaneously contacted trial centres.

Trial centres are listed on bmj.com

Interventions

We developed the study interventions in a consensus process with German acupuncture experts and societies.[4] Physicians trained (at least 140 hours, median 500 hours) and experienced (median 10 years) in acupuncture delivered the interventions. Both the acupuncture and minimal acupuncture treatments consisted of 12 sessions of 30 minutes, given over eight weeks (preferably two sessions in each of the first four weeks, followed by one session a week in the remaining four weeks).

Acupuncture treatment was semistandardised. All patients were treated at "basic" points bilaterally unless explicit reasons for not doing so were given; additional points could be chosen individually (box 1). We instructed physicians to achieve "de qi" (an irradiating feeling considered to be indicative of effective needling) if possible and to stimulate needles manually at least once during each session. The total number of needles was limited to 25 per session.

The number, length, and frequency of the sessions in the minimal acupuncture group were the same as for the acupuncture group. In each session, physicians needled at least five out of 10 predefined distant non-acupuncture points (box 2) bilaterally (at least 10 needles) and superficially using fine needles. Physicians avoided "de qi" and manual stimulation of the needles.

Patients in the waiting list control group did not receive any prophylactic treatment for their headaches for a period of 12 weeks after randomisation. After that time, they received 12 sessions of the acupuncture treatment described above.

All patients were allowed to treat acute headaches as needed. Treatment was supposed to follow current guidelines[5] and had to be documented in the headache diary.

Patients were informed with respect to acupuncture and minimal acupuncture as follows: "In this study, different types of acupuncture will be compared. One type is similar to the acupuncture treatment used in China. The other type does not follow the principles of traditional Chinese medicine, but has also been associated with positive outcomes in clinical studies."

Box 1: Acupuncture points used in the trial

All physicians used sterile, disposable, single use needles but were free in their choice of length and diameter of needle

Basic points

- Gall bladder (GB) 20
- GB 21
- Liver (LIV) 3

Optional points

- Mainly frontal headache: large intestine (LI) 4, Du Mai (DU) 23, extra points Yintang and Taiyang, stomach (ST) 44, GB 2
- Headache mainly in the vertex: DU 20 or 23, extra point Si Shen Cong
- Mainly neck pain: bladder (BL) 10, 60, or 62; DU 14 or 19; small intestine (SI) 3 or 6
- Holocephalic pain with fatigue: extra point Taiyang, spleen (SP) 6 or 9, ST 36 or 40, Ren Mai (REN) 12
- Worse with wet or cold weather: LI 4, DU 14, GB 3, Sanjiao (SJ) 6, GB 39
- Modalities wind, dampness, cold: LI 4, DU 14, SJ 6, GB 34
- Modalities cold, wind: LI 4, lung (LU) 7, SJ 5, DU 14

Outcome measurement

All patients filled in headache diaries in the four weeks before randomisation (baseline phase), the 12 weeks after randomisation, and weeks 21 to 24 after randomisation. In addition, we asked patients to fill in a pain questionnaire before treatment, after 12 weeks, and after 24 weeks.[6] This included the following validated scales: the German version of the pain disability index,[7] a scale for assessing sensoric and affective aspects of pain (Schmerzempfindungs-Skala SES),[8] the ADS depression scale,[9] and the German version of the SF-36 to assess health related quality of life.[10] The primary outcome measure was the difference in number of days with headache between the four weeks before randomisation (baseline phase) and weeks nine to 12 after randomisation.

To test blinding to treatment and assess the credibility of the different treatment methods, patients filled in a credibility questionnaire after the third acupuncture session.[11] At the end of the study, patients were asked whether they thought that they had received acupuncture following the principles of Chinese medicine or the other type of acupuncture.

Statistical methods

We based confirmatory testing of the primary outcome measure and all main analyses (with SPSS 11.5) on the intention to treat population and used all available data. We used SOLAS 3.0 (Statistical Solutions, Cork, Ireland) to do sensitivity analyses for the primary outcome measure, replacing missing data with baseline values or multiple imputation. We tested a priori ordered two sided null hypotheses by using Student's t test (significance level 0.05). In the first step we investigated whether acupuncture reduced the number of days with headache more than no treatment, and in the second step (only if the first null hypothesis was rejected) we investigated whether acupuncture was more efficacious than minimal acupuncture. We give exploratory analyses (analysis of covariance adjusting for baseline differences and χ^2 tests) for predefined secondary outcome measures. We did an additional per protocol analysis including only patients without major protocol violations until week 12.

We made the original sample size calculation for one sided testing. Under this premise we planned the study to have 80% power to detect a group difference of two days with headache assuming a standard deviation of five days (thus an effect size of 0.4) and a 20% dropout rate.[4] However, we later decided to use

Box 2: Minimal acupuncture points used in the trial

- "Deltoideus"—in the middle of the line insertion of M deltoideus (LI 14) and acromion
- "Upper arm"—2 cun laterally of LU 3
- "Forearm"—1 cun ulnar of the proximal third of the line between heart (HE) 3 and HE 7
- "Scapula"—1 cun laterally of the lower scapular edge
- "Spina iliaca"—2 cun above spina iliaca anterior superior in vertical line to the arch of left ribs
- "Back I"—5 cun laterally of the spine of lumbar vertebrum IV
- "Back II"—5 cun laterally of the spine of lumbar vertebrum V
- "Upper leg I"—6 cun above the upper edge of the patella (between the spleen and stomach meridians)
- "Upper leg II"—4 cun above the upper edge of the patella
- "Upper leg III"—2 cun dorsally of GB 31 (avoiding bladder meridian)

A cun is defined according to the rules of traditional acupuncture as the width of the interphalangeal joint of the patient's thumb

two sided testing to comply better with common standards. Before starting the analysis, and on the basis of the recommendation of the ethical review board, we decided to exclude the data from one centre that had included 26 patients, owing to repeated severe protocol deviations and the suspicion of data manipulation in some patients. We decided to do a sensitivity analysis including this centre's data.

Results

Participants, treatment, and blinding

Between March 2002 and January 2004, approximately 2700 patients with headache expressed an interest in participating in the study; 524 entered the four week baseline period, and 296 patients recruited in 29 outpatient centres were randomised (fig 1). As described above, we excluded from the main analysis one trial centre with 26 patients, leaving 270 patients in the intention to treat population (132 acupuncture, 63 minimal acupuncture, 75 waiting list).

Groups were comparable at baseline in most respects (table 1). However, we observed some differences in previous use of acupuncture and in parts of the pain questionnaire. After three sessions, patients rated the credibility of acupuncture and minimal acupuncture very highly and very similarly (table 2). At the end of the study, patients' guesses as to their allocation status did not differ significantly between groups, but patients in the acupuncture group guessed their allocation correctly slightly more often than did patients in the minimal acupuncture group.

Effectiveness

From baseline to week 9-12, the number of days with headache decreased by 7.2 (SD 6.5) days in the acupuncture group compared with 6.6 (SD 6.0) days in the minimal acupuncture group and 1.5 (SD 3.7) days in the waiting list group (difference:

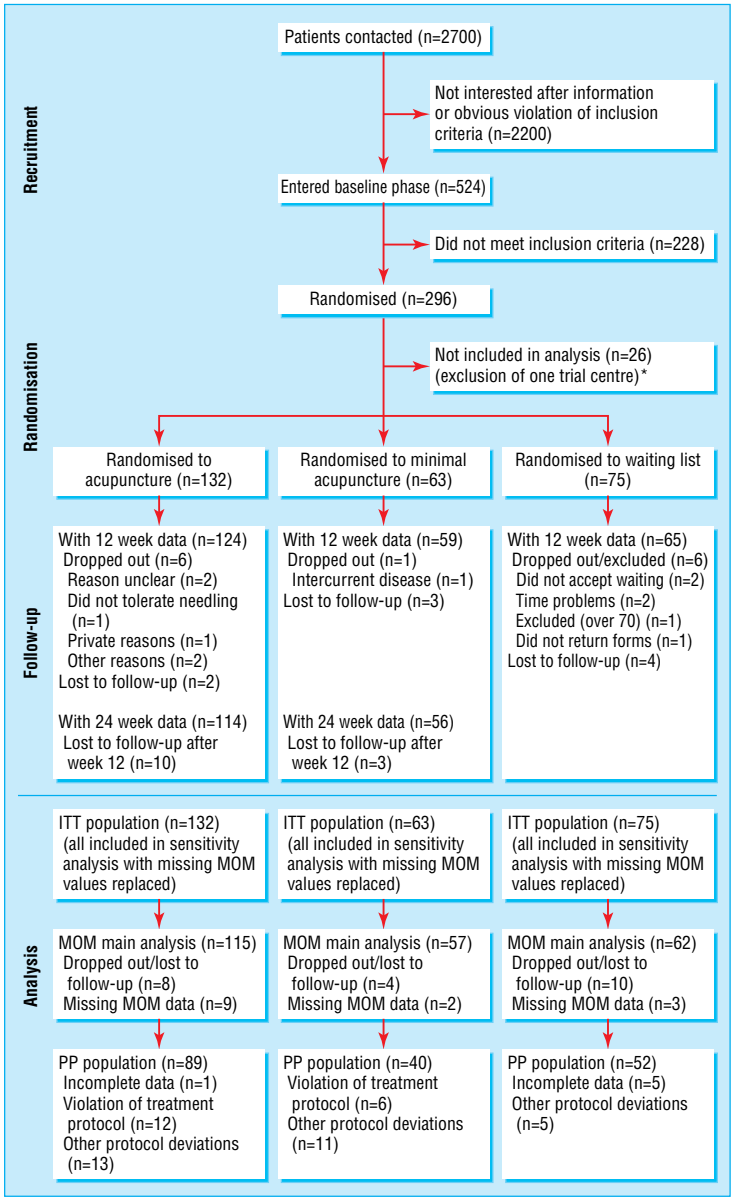

Fig 1 Flowchart of trial (ITT=intention to treat; MOM=main outcome measure; PP=per protocol). *Before starting analyses the data from one trial centre were excluded from the main analysis owing to severe protocol violations and suspicion of data manipulation; the data were included in an additional sensitivity analysis (see methods section)

Table 1 Baseline characteristics

Characteristic	All patients (n=270): No (%)	Acupuncture (n=132): No (%)	Minimal acupuncture (n=63): No (%)	Waiting list (n=75): No (%)
Female	199 (74)	95 (72)	46 (73)	58 (77)
Diagnosis according to IHS criteria:				
Episodic tension-type headache	146 (54)	75 (57)	31 (49)	40 (53)
Chronic tension-type headache	124 (46)	57 (43)	32 (51)	35 (47)
Previous acupuncture (for any condition)	111 (41)	46 (35)	34 (54)	31 (41)
Reason for participation:				
Current headaches particularly severe	65 (24)	31 (24)	13 (21)	21 (28)
Expected improvement due to acupuncture	261 (97)	130 (99)	61 (97)	70 (93)
Avoid drugs	165 (61)	81 (61)	37 (59)	47 (63)
Other	33 (12)	14 (11)	9 (14)	10 (13)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age (years)	42.7 (13.2)	42.3 (13.5)	43.4 (12.9)	42.8 (13.2)
Body mass index	24.2 (3.9)	24.5 (4.3)	24.5 (3.5)	23.4 (3.6)
Duration of disease (years)	14.5 (11.8)	13.7 (11.1)	16.8 (13.8)	14.1 (11.1)
Days with headache*	17.5 (6.8)	17.5 (6.9)	17.7 (6.7)	17.3 (6.9)
Hours with headache*	161 (138)	153 (131)	167 (148)	169 (144)
Headache score*†	30.0 (13.5)	29.9 (14.1)	30.9 (12.8)	29.3 (13.0)
Days with more than mild headache*	9.7 (6.3)	9.8 (6.5)	10.0 (5.8)	9.4 (6.3)
Days with medication*	4.3 (4.0)	4.0 (3.7)	4.2 (4.2)	4.7 (4.2)
Disability (PDI)	22.4 (11.4)	21.4 (11.3)	22.0 (11.4)	24.6 (11.3)
SF-36 physical health‡	43.2 (7.2)	42.9 (7.2)	44.3 (6.8)	43.0 (7.5)
SF-36 mental health‡	44.2 (11.2)	45.6 (10.5)	44.1 (12.1)	41.4 (11.3)
Depression (ADS)	52.4 (9.0)	51.9 (8.3)	52.2 (10.7)	53.6 (8.6)
Pain sensoric (SES t standard scores)	47.1 (7.5)	45.8 (6.3)	50.2 (8.6)	46.7 (7.9)
Pain affective (SES t standard scores)	49.3 (7.8)	47.5 (7.3)	50.6 (8.0)	51.5 (7.9)
Average pain (scale 1-10)	4.7 (1.6)	4.5 (1.5)	4.9 (1.5)	4.9 (1.7)

ADS=depression scale (Allgemeine Depressionsskala); IHS=International Headache Society; PDI=pain disability index; SES=questionnaire for assessing sensoric and affective aspects of pain (Schmerzempfindungsskala).
*Per four weeks.
†Headache score=sum of intensity ratings (1=mild, 2=moderate, 3=severe) of days with headache.
‡Higher values indicate better status.

acupuncture *v* minimal acupuncture, 0.6 days, 95% confidence interval −1.5 to 2.6 days, P=0.58; acupuncture *v* waiting list, 5.7 days, 4.2 to 7.2 days, P<0.001) (fig 2). Results were very similar in sensitivity analyses and in the per protocol analysis. The proportion of responders (at least 50% reduction in headache days, counting all patients with missing data as non-responders) was 46% in the acupuncture group, 35% in the minimal acupuncture group, and 4% in the waiting list group (exploratory P values 0.163 for acupuncture *v* minimal acupuncture and <0.001 for acupuncture *v* waiting list).

Table 2 Questions about credibility of treatment after third treatment session (rating scale with 0=disagreement and 6=maximal agreement) and guess at end of week 24 as to which type of acupuncture had been received

	Acupuncture	Minimal acupuncture	P value*
Credibility after third session	**Mean (SD) (n=127)**	**Mean (SD) (n=63)**	
Improvement expected	4.8 (1.0)	4.8 (1.1)	0.70*
Recommendation to others	5.3 (0.9)	5.4 (1.0)	0.35*
Treatment logical	4.5 (1.2)	4.8 (1.3)	0.22*
Effective also for other diseases	5.6 (0.7)	5.6 (0.6)	0.46*
Guess at end of week 24	No (%) (n=113)	No (%) (n=54)	0.08†
"Chinese acupuncture"	63 (56)	20 (37)	
"The other type of acupuncture"	19 (17)	12 (22)	
"Don't know"	31 (27)	22 (41)	

*Two sided *t* test.
†χ^2 test.

Compared with the waiting list control group, patients receiving acupuncture or minimal acupuncture fared significantly better for most secondary outcome measures; however, we found no significant differences between the acupuncture and the minimal acupuncture group (table 3). Differences compared with waiting list became apparent in the headache diary after the first four weeks of treatment and increased until week 12 (fig 2).

The improvements seen in the acupuncture and minimal acupuncture group persisted during the follow-up period (table 4). The patients in the waiting list group who received acupuncture in weeks 13-20 also showed significant improvements after treatment, although not to the same extent as the patients who had received immediate treatment.

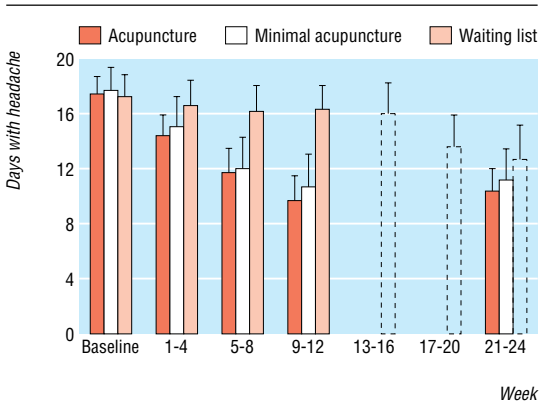

Fig 2 Mean (95% confidence interval) number of days with headache. Patients in the waiting list group received acupuncture after week 12 (dotted bars)

Table 3 Secondary outcome measures after treatment

	Acupuncture		Minimal acupuncture		Waiting list		Acupuncture *v* minimal acupuncture		Acupuncture *v* waiting list	
Outcome	**No**	**Mean (SD)**	**No**	**Mean (SD)**	**No**	**Mean (SD)**	**Difference* (95% CI)**	**P value†**	**Difference* (95% CI)**	**P value†**
Headache diary weeks 9-12										
Days with headache	118	9.9 (8.7)	57	10.8 (8.3)	63	16.3 (7.4)	−0.6 (−2.4 to 1.2)	0.51	−5.8 (−7.6 to −4.0)	<0.001
Hours with headache	118	88 (128)	57	111 (162)	63	164 (145)	−8 (−33 to 17)	0.51	−48 (−72 to −23)	<0.001
Headache score‡	118	15.8 (15.3)	57	17.2 (14.4)	63	26.4 (14.3)	−0.8 (−4.4 to 2.7)	0.64	−10.9 (−14.3 to −7.4)	<0.001
Days with more than mild headache	118	4.8 (6.2)	57	4.6 (5.3)	63	8.4 (6.8)	0.3 (−1.2 to 1.8)	0.68	−4.0 (−5.4 to −2.6)	<0.001
Days with analgesic drugs	117	1.9 (2.9)	57	2.6 (2.6)	63	4.4 (4.1)	−0.6 (−1.4 to 0.2)	0.12	−2.3 (−3.1 to −1.6)	<0.001
Pain questionnaire week 12										
Disability (PDI)	119	12.2 (10.8)	57	13.5 (11.5)	63	22.8 (9.7)	−1.4 (−4.3 to 1.5)	0.35	−8.8 (−11.7 to −5.9)	<0.001
SF-36 physical health§	119	48.2 (7.5)	57	49.0 (6.1)	63	42.5 (7.2)	−0.2 (−2.0 to 1.6)	0.83	5.4 (3.7 to 7.2)	<0.001
SF-36 mental health§	119	47.4 (9.8)	57	46.1 (11.8)	63	41.9 (10.9)	0.0 (−2.4 to 2.5)	0.97	2.5 (0.2 to 4.9)	0.04
Depression (ADS)	111	47.4 (9.1)	53	49.0 (11.5)	59	53.9 (9.3)	−0.5 (−3.0 to 2.0)	0.70	−5.0 (−7.4 to −2.6)	<0.001
Pain affective (SES t standard scores)	119	42.9 (8.3)	57	45.3 (9.4)	62	50.1 (8.4)	−0.7 (−2.9 to 1.5)	0.54	−4.3 (−6.4 to −2.1)	<0.001
Pain sensoric (SES t standard scores)	119	44.3 (7.4)	56	47.1 (8.6)	62	47.0 (8.2)	−0.4 (−2.5 to 1.6)	0.69	−2.6 (−4.5 to −0.6)	0.01
Average pain (scale 1-10)	119	2.9 (1.6)	58	3.1 (1.7)	63	4.6 (1.5)	−0.1 (−0.6 to 0.4)	0.77	−1.6 (−2.1 to −1.1)	<0.001

ADS=depression scale (Allgemeine Depressionsskala); PDI=pain disability index; SES=questionnaire for assessing emotional aspects of pain (Schmerzempfindungsskala).
*Mean difference between groups.
†Analysis of covariance with adjustment for baseline values.
‡Headache score=sum of intensity ratings (1=mild, 2=moderate, 3=severe) of days with headache.
§Higher values indicate better status.

Safety

Within the 24 weeks after randomisation a total of three serious adverse events (two acupuncture, one waiting list) were documented. All cases were hospital stays considered unrelated to the study (two diagnostic interventions, one elective surgery). Twenty three patients in the acupuncture group reported a total of 30 side effects compared with 11 patients in the minimal acupuncture group reporting a total of 14 side effects. The most commonly reported side effects were triggering of headache or other pain, haematoma, and dizziness.

Discussion

Principal finding

The acupuncture intervention tested in this study was significantly more effective than no preventive treatment but not significantly more effective than the minimal acupuncture intervention in patients with tension-type headache.

Strength and weaknesses

Compared with available studies of acupuncture for tension-type headache,[12–17] which included up to a maximum of 69 patients, our study has a much larger sample size. Other advantages include adherence to current guidelines for headache trials,[18] strictly concealed central randomisation, an assessment of the credibility of interventions, blinded evaluation of diaries, interventions based on expert consensus provided by qualified and experienced medical acupuncturists, high follow-up rates, and an external audit of the quality of data.

Although the groups were comparable for sociodemographic characteristics and headache outcomes at baseline, differences existed for some scores on the pain questionnaire in

Table 4 Secondary outcome measures at follow-up

	Acupuncture		Minimal acupuncture		Acupuncture *v* minimal acupuncture	
Outcome	**No**	**Mean (SD)**	**No**	**Mean (SD)**	**Difference* (95% CI)**	**P value†**
Headache diary weeks 21 to 24						
Days with headache	112	10.4 (8.6)	55	11.2 (8.6)	−0.7 (−2.8 to 1.3)	0.48
Hours with headache	110	96 (137)	54	118 (166)	−12 (−40 to 15)	0.38
Headache score‡	112	17.6 (16.7)	55	18.6 (16.2)	−0.7 (−5.0 to 3.6)	0.76
Days with more than mild headache	112	5.6 (6.8)	55	5.6 (7.1)	0.0 (−1.8 to 1.8)	0.98
Days with medication	112	2.3 (4.0)	55	2.9 (3.5)	−0.5 (−1.6 to 0.7)	0.43
Pain questionnaire week 24						
Disability (PDI)	112	11.2 (11.4)	54	10.8 (10.3)	−0.1 (−3.3 to 3.2)	0.97
SF-36 physical health§	112	48.1 (6.9)	54	49.1 (5.4)	−0.1 (−1.8 to 1.7)	0.90
SF-36 mental health§	112	47.2 (10.3)	54	47.6 (10.1)	−1.5 (−4.2 to 1.3)	0.29
Depression (ADS)	104	47.6 (10.4)	51	48.3 (10.2)	0.6 (−2.2 to 3.4)	0.69
Pain affective (SES t standard scores)	112	42.5 (8.2)	52	44.5 (8.7)	−0.9 (−3.5 to 1.7)	0.49
Pain sensoric (SES t standard scores)	113	44.6 (8.0)	51	47.3 (9.5)	−0.5 (3.1 to 2.1)	0.70
Average pain (scale 1-10)	113	2.8 (1.8)	54	3.1 (1.8)	−0.2 (−0.8 to 0.4)	0.47

ADS=depression scale (Allgemeine Depressionsskala); PDI=pain disability index; SES=questionnaire for assessing emotional aspects of pain (Schmerzempfindungsskala).
*Mean difference between groups.
†Analysis of covariance with adjustment for baseline values.
‡Headache score=sum of intensity ratings (1=mild, 2=moderate, 3=severe) of days with headache.
§Higher values indicate better status.

spite of randomisation. The credibility of acupuncture and minimal acupuncture was rated very similarly by patients, but guesses about treatment allocation at the end of the trial differed slightly between the acupuncture and minimal acupuncture groups, which might indicate some degree of unblinding. Trial physicians could not be blinded. Therefore, the small non-significant differences between acupuncture and minimal acupuncture could be due to bias. It was not possible to blind waiting list patients, so we cannot rule out that the difference from acupuncture and minimal acupuncture is overestimated. However, several arguments exist as to why the influence of bias should be limited. A slight improvement over time occurred in the waiting list group in the first 12 weeks; this was probably due to the natural course of the disease. This improvement, however, makes it unlikely that patients in the waiting list group reported negatively biased data in their diaries. Use of analgesics was lower in both the acupuncture and minimal acupuncture groups than in the waiting list group, making an influence of effective co-interventions unlikely. Follow-up data confirmed the improvements observed after treatment. After completion of the treatment, patients had no further contact with acupuncturists; they received and sent diaries and questionnaires directly to the study centre, decreasing the likelihood of positively biased diary data.

Interpretation of findings

The lack of significant differences between acupuncture and minimal acupuncture in our study indicates that point location and other aspects considered relevant for traditional Chinese acupuncture did not make a major difference. Although our treatment strategy was consensus based, we cannot rule out the possibility that a different approach would have yielded a different result. Our findings are similar to those of three of the available trials,[12 13 16] whereas two found significant effects of acupuncture over sham acupuncture.[15 17] A recent large, pragmatic trial from the United Kingdom found that adding acupuncture to general practitioners' care for headache was more effective than general practitioners' care alone.[19] This trial mainly included patients with migraine, however, and subgroup analyses suggested that patients with tension-type headache might benefit less.

An intriguing finding of our trial is the strong and lasting response to minimal acupuncture. The improvement over, and the differences compared with, the waiting list group are clearly clinically relevant. The minimal acupuncture intervention in our study was designed to minimise potential physiological effects by needling superficially at points distant from classical sites as well as by using fewer needles than in the acupuncture group. However, it cannot be considered completely inert. The physiological effects of superficial needling distant from classical acupuncture sites may include local alteration in circulation as well as a wide range of neurophysiological and neurochemical responses such as release of neurotransmitters or activation of segmental and heterosegmental antinociceptive systems.[20]

Another explanation for the improvements we observed could be that acupuncture and minimal acupuncture are associated with particularly potent placebo effects. Some evidence shows that complex medical interventions or medical devices have higher placebo effects than placebo drugs.[21] Acupuncture treatment has characteristics that are considered relevant in the context of placebo effects.[22] It has an "exotic" conceptual framework with emphasis on the "individual as a whole," it is associated with frequent patient-practitioner contacts, and it includes the repeated "ritual" of needling. Finally, the high expectations of participants and our way of informing patients might have been a relevant factor.

What is already known on the topic

Acupuncture is widely used in patients with tension-type headache

Available trials had small sample sizes and controversial results

What this study adds

In this randomised trial, acupuncture had a significant and clinically relevant effect over no treatment

However, minimal acupuncture (superficial needling distant from traditional acupuncture points) had a similar effect

Conclusions

A significant proportion of patients with tension-type headache benefited from acupuncture. The size of the effect seems comparable to those of accepted treatments for tension-type headache and is larger than that found in most trials comparing placebo interventions with no treatment.[23 24] Acupuncture was well tolerated, and improvements lasted several months after completion of treatment. However, minimal acupuncture—the superficial needling of non-acupuncture points—had a similar effect.

We thank the acupuncture experts who participated in the consensus process to establish the trial interventions. Trial centres contributing to the main analysis are listed on bmj.com. The trial was initiated after a request from German health authorities (Federal Committee of Physicians and Social Health Insurance Companies, German Federal Social Insurance Authority) and sponsored by German Social Health Insurance Companies. The health authorities had requested a randomised trial including a sham control condition with an observation period of at least six months to decide whether acupuncture should be included in routine reimbursement. All other decisions on design, data collection, analysis, and interpretation, as well as publication, were the responsibility of the researchers.

Contributors: All authors participated in the planning of the protocol and revision of manuscript drafts. DM, KL, AS, BB, and CW were responsible for general trial coordination. AS and AH were responsible for monitoring trial centres' activities. SW, WW, and KL did the statistical analysis. SW was responsible for randomisation. VP provided neurological expertise. MH, JH, and DI developed the acupuncture intervention. SNW and DM had general medical and scientific responsibility. DM, AS, BB, CW, SNW, and KL are guarantors.

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Centre for Complementary Medicine Research, Department of Internal Medicine II, Technische Universität München, Kaiserstr 9, 80801 Munich, Germany
Dieter Melchart *director*
Andrea Streng *researcher*
Andrea Hoppe *researcher*
Wolfgang Weidenhammer *biostatistician*
Klaus Linde *epidemiologist*

Institute of Medical Statistics and Epidemiology, Technische Universität München
Stefan Wagenpfeil *statistician*

Department of Neurology, Technische Universität München
Michael Hammes *neurologist*

Institute of Social Medicine, Epidemiology, and Health Economics, Charité University Medical Centre, Berlin, Germany
Benno Brinkhaus *internist*
Claudia Witt *epidemiologist*
Stefan N Willich *professor*

Private practice, Munich
Volker Pfaffenrath *neurologist*
Josef Hummelsberger *internist*

Department of Anesthesiology, University of Munich, Munich
Dominik Irnich *anaesthetist*

Division of Complementary Medicine, Department of Internal Medicine, University Hospital Zurich, Switzerland
Dieter Melchart *researcher*

Correspondence to: K Linde Klaus.Linde@lrz.tu-muenchen.de