Effects of different imagery strategies in the psychological treatment of chronic headache

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This study investigates the effects of four different imagery techniques: pleasant imagery versus imaginative transformations, and response versus stimulus imagery. One may expect imaginative transformations to be more effective than pleasant imagery. Response imaginative transformations should be more effective than stimulus imaginative transformations, while the pleasant imagery conditions are not expected to have different effects. In a 2x2 design, treatment conditions were compared. Forty patients (33 females, seven males) with different types of chronic headache were referred by their physicians and took part in the study. Pain diaries and questionnaires of pain experience and pain behaviour were used as outcome measures. Imaginative transformations – irrespective of response or stimulus orientation – were found to be more effective than pleasant imagery in reducing headache frequency. Reductions remained stable over an eight-month follow-up. There are no significant differences between response and stimulus imagery. Treatment effects were manifested in a reduction of headache frequency, while headache duration and headache intensity did not change. Suffering and avoidance behaviours were reduced in all treatment groups, while the use of distraction strategies was increased. The reductions in suffering were significantly greater in the groups treated with imaginative transformations. In the eight-month follow-up, group differences in reductions in suffering were no longer significant, which is probably due to the reduced sample size. The results support the hypothesis that a cognitive redefinition is responsible for the beneficial treatment effects because only instructions to imagine a change in pain sensations and/or pain responses led to significant improvements.

Key Words: *Chronic headache, Cognitive strategies, Imagery*

Effets de différentes techniques de visualisation dans le traitement psychologique de la céphalée chronique

RÉSUMÉ : La présente étude examine les effets de quatre techniques différentes de visualisation : des représentations plaisantes par rapport à des transformations imaginatives, et des représentations de la réponse par rapport à des représentations du stimulus. On peut s'attendre à ce que les transformations imaginatives soient plus efficaces que les représentations plaisantes. Quant aux transformations imaginatives de la réponse, elles devraient être plus efficaces que les transformations imaginatives du stimulus, alors qu'on ne s'attend pas à ce que les conditions de représentations plaisantes aient des effets différents. On a comparé les modalités de traitement dans un modèle de Zapf de 2x2. Quarante patients (33 femmes, sept hommes) souffrant de différents types de céphalée chronique ont été adressés par leur médecin et ont participé à l'étude. Des agendas de la douleur et des questionnaires sur l'expérience de la douleur et le comportement face à la douleur ont été utilisés comme mesures des résultats. Les transformations imaginatives – sans tenir compte d'une orientation de la réponse ou du stimulus – se sont révélées plus efficaces qu'une représentation plaisante pour réduire la fréquence de la céphalée. Ces réductions sont demeurées stables tout au long d'une période de suivi de huit mois. Il n'y a aucune différence significative entre la représentation de la réponse et la représentation du stimulus. Les effets du traitement se manifestaient par une diminution de la fréquence de la céphalée alors que sa durée et son intensité demeuraient inchangées. Dans tous les groupes de traitement, une plus grande utilisation des techniques de distraction entraînait une diminution des comportements de souffrance et d'évitement. Dans les groupes traités à l'aide de transformations imaginatives, les réductions de la souffrance étaient nettement plus élevées. Dans la période de suivi de huit mois, les différences entre les groupes en ce qui concerne la diminution de la souffrance n'étaient plus significatives, ce qui est probablement dû à une diminution de la taille de l'échantillon. Ces résultats renforcent l'hypothèse qu'une redéfinition cognitive est responsable des effets bénéfiques du traitement parce que seules les instructions visant à imaginer un changement dans les sensations de la douleur et/ou dans les réponses à la douleur ont permis d'obtenir des améliorations significatives.

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Imagery techniques have been widely used in the control of experimental and clinical pain. Turk et al (1) named two different imagery strategies: pleasant imagery and imaginative transformations of pain and/or of context. While pleasant imagery is supposed to work as an internal distractor, imaginative transformation is a cognitive redefinition technique.

Distraction certainly is acknowledged as a powerful strategy for reducing pain. Many studies have found pleasant imagery to be effective in attenuating experimentally induced pain compared with results from those in a nontreatment group (2-6) or expectation control group (2,4,7).

Imaginative transformations of pain or of context proved effective compared with results from a nontreatment control group (3,5,8-11). Direct comparisons of pleasant imagery and imaginative transformations show the latter to be more effective (3,5).

In a comprehensive review of the research on control of experimental pain, McCaul and Malott (12) point out that while distraction is effective in reducing pain, redefinition strategies tend to be more effective – especially when higher pain intensities are involved.

In most studies on chronic pain (13-23), complex treatment programs consisting of several strategies have been investigated. Therefore, the effects of single strategies still remain unclear.

Brown (24) found pleasant imagery to be effective in reducing migraine headache. Rybstein-Blinchik (25) treated patients with different types of chronic pain with distraction or redefinition techniques; redefinition strategies resulted in greater pain reductions than distraction.

Lang's (26,27) research on fear-related imagery has suggested a way of maximizing the efficacy of imaginal strategies. Lang suggested that in order for systematic desensitization to be effective, subjects must be able to imagine vividly the fearful scenes. He rejected the traditional notion of vivid imagery, ie, the notion of detailed pictures in the mind. He argued that to be vivid the image must include not only the details of the scene (stimulus information), but also the responses the subject would have if he or she were actually in the scene (response information).

Response and stimulus *pleasant* imagery were compared in a study by Brown (24), but no differences in results were found between these conditions. However, Lang (26,27) suggested that response imagery is more effective when fear-related, not pleasant, scenes are imagined because the relevant responses are evoked. Therefore, one expects Lang's hypothesis to be valid with redefinition strategies, where pain responses can be evoked and subsequently transformed.

The present study investigates the effects of four different imagery techniques in a 2x2 design: pleasant imagery versus imaginative transformations, and response versus stimulus imagery.

We expect imaginative transformations to be more effective for headache reduction than pleasant imagery. Response imaginative transformations should be more effective than stimulus imaginative transformations, while the pleasant imagery conditions are not expected to produce different effects.

PATIENTS AND METHODS

Subjects

Forty patients (33 females and seven males) with chronic headache of different type (23 migraine, seven tension headache, 10 migraine and tension headache; all diagnosed by a physician) were chosen for the study and completed treatment. There were five drop-outs: one each in the stimulus pleasant (SP) group, the stimulus transformation (ST) group and the response transformation (RT) group, and two in the response pleasant (RP) group. Patients were referred to the program by their physicians. Mean age was 43.2 years (SD=10.8) and mean duration of headache problem was 24.1 years (SD=12.8). Patients with psychiatric problems or whose headache problem lasted less than a year were not included in the study.

Patients were randomly assigned to treatment conditions. The four treatment groups did not differ from each other in age or duration and type of headache problem.

Most patients (n=25) were married. Ten patients already had received some type of psychotherapy for their headache problem. These variables were equally distributed among the four treatment groups.

Participants received no psychological treatment during the course of the study. All patient received some analgesic medication from their physicians. Two patients in each group received prophylactic medication for migraine. All pharmacological treatments had begun at least four weeks before baseline. Type of medication, and type and dose of prophylactic medication were not changed during the course of the study.

Procedure

Baseline: The rationale of the specific treatment was explained to the patients. All patients were given a model of how fear of pain and expectation of pain can produce new pain episodes. They were told that imagery instructions are able to change these expectations. For the pleasant imagery conditions it was emphasized that the images used must be pleasant and relaxing. In the transformation conditions, it was stressed that in order to change a negative experience such as pain, a transformation from negative to pleasant images must occur. In the stimulus conditions, rather than use the words 'picture' or 'scene' in the response conditions, 'experience', 'reaction' or 'feeling' was used. Patients were asked to provide personal examples to ensure that they understood the rationale.

Patients were asked to complete the following questionnaires: the Hamburg Pain Adjective List (HPAL) (28,29), the Pain Behaviour List (PBL) (28) and a translation of the questionnaire of mental imagery (30). The HPAL consists of two affective (suffering and fear) and two sensory (sharp quality and rhythmic quality of pain) descriptor scales. The PBL comprises avoidance, help-seeking and distraction scales.

These are reliable and valid instruments commonly used in German language samples. (The internal consistency [alpha] of the questionnaire scales lies between 0.84 and 0.92, the retest reliability lies between 0.76 and 0.89. Different validity studies rendered significant correlations with other pain measures [30].)

Patients filled in a headache diary during a four-week baseline phase. The headache diary required hourly ratings on a verbal rating scale ranging from 0 (no pain) to 5 (very severe pain). Type and amount of medication were recorded daily.

Response/stimulus training: Two response or two stimulus imagery training sessions were conducted individually. The procedure described by Lang (26) and Lang et al (31) was followed: patients were read short imagery instruction – either response or stimulus. After a 30 s imagery phase, patients were asked to describe their imagery. In the response conditions, descriptions of movements and physical reactions were reinforced; in the stimulus condition, descriptions of what was seen, heard or felt were reinforced.

Treatment phase: Ten 1 h treatment sessions followed the response/stimulus training session. Each treatment session consisted of two imagery phases, each preceded by short relaxation instruction. There were two phases, simply to space treatment within a session. Relaxation was included to help patients to concentrate on the following imagery. Treatment was conducted individually.

The HPAL and the PBL were presented again after the first, fifth and 10th treatment sessions. Patients filled in the headache diary throughout treatment.

Follow-up I: Patients recorded headache activity again using the headache diary for an eight-week follow-up-phase, after which they redid the HPAL and PBL.

Follow-up II: Eight months after the end of treatment, patients were sent the HPAL, PBL and a two-week headache diary.

Treatment methods

Four parallel text programs of imagery instructions were constructed. In the imaginative transformation treatment condition, the patient imagines that the painful sensation will cease and that he or she will grow insensitive or indifferent to pain. Each imagery instruction ends with a pleasant scene. In the pleasant imagery condition only pleasant and relaxing scenes are described.

The following text provides an example of a response imaginative transformation imagery instruction (abbreviated).

Imagine you are walking down a street on a rainy night. The cold rain runs over your face. Your hair is wet. You shiver...You pull up your shoulders. Your muscles are tense. You walk as fast as you can. You strain the muscles of your legs...Your teeth clatter. You shiver...You are breathing faster. Your heart is pounding...Your face is cold and aches with cold....

Gradually your face gets numb. The cold disappears. The pain disappears...You are walking fast and your muscles get warmer while you move. You don't care about the rain. The cold and the pain disappear...You take a deep breath. You lift your head and relax your neck and shoulders. You let your arms swing loosely while you walk. The tension is going away....

And now you see the sign of an inn appearing out of the rain...You enter...There is a fireplace. You sit down in front of the fire. You lay back in your chair and relax. You stretch your legs. You rest your arms on your thighs. You lay back your head and relax your neck and shoulders...You breathe deeply. Your heart beats slowly...You are warm. The muscles of your face are relaxed. You feel fine....

The stimulus imaginative transformation group is presented the same text without response instructions and with more stimulus details.

Imagine you are walking down a street on a rainy night. The cold rain runs over your face. Your hair is wet. You see the rain falling. The street is wet and full of puddles...It is dark: you see the dim streetlights. You can hear the rain patter on the street...Your coat is getting wet. You see the rain falling into the puddles...Your face is cold and aches with cold.

Gradually your face gets numb. The cold disappears. The pain disappears...You get warmer. You don't care about the rain. The cold and the pain disappear...You realize that the air is fresh and clean. You see the raindrops shimmer in the light of the street lamps. The light is reflected in the puddles on the street. You hear the patter of the rain.

And now you see the sign of an inn appearing out of the rain...You enter...There is a fireplace. You sit down in front of the fire. You see the flames flicker. You see the red glowing centre of the fire. You hear the fire crackle. You feel the warmth in your face. Your feet get warm...You look around. The room is lit by the red glow of the fire...You are warm. Your face is warm. You feel fine.

For the two groups with pleasant imagery the whole scene is described as pleasant. Here is a very short example of the response pleasant imagery condition.

You are walking in the warm rain. The air is fresh and clean. You breathe deeply...You walk with big steps. You let your arms swing with each step. Your muscles are relaxed...Your muscles are warm.

TABLE 1
Means, SDs and MANOVA results of the headache diary variables

Variable	Measurement	SP mean (SD)	RP mean (SD)	ST mean (SD)	RT mean (SD)	MANOVA
Headache frequency	Baseline	3.29 (2.51)	2.86 (1.79)	2.82 (1.34)	3.18 (1.99)	Main effect time: $F_{(4,33)}=4.35$; $P\leq0.006$
	Training	3.33 (2.24)	2.74 (1.91)	2.84 (1.65)	2.87 (1.90)	Linear trend: $F_{(1,39)}=8.94$; $P\leq0.005$
	Treatment 1	3.29 (2.46)	3.11 (1.73)	2.56 (1.08)	2.01 (1.81)	Two-way interaction effect cognitive strategy x time: $F_{(4,33)}=3.69$; $P\leq0.014$
	Treatment 2	3.44 (2.27)	2.80 (1.75)	2.56 (1.01)	2.49 (1.94)	Simple effect time within ST/RT: $F_{(4,33)}=7.76$; $P\leq0.000$;
	Follow-up I	3.35 (2.24)	2.63 (1.81)	1.85 (1.57)	1.85 (1.58)	Linear trend within ST/RT: $F_{(1,36)}=19,89$; $P\leq0.000$
	Follow-up II	3.64 (2.45)	3.29 (1.98)	1.93 (1.36)	1.36 (1.69)	
Headache duration	Baseline	7.69 (3.58)	8.52 (4.32)	7.10 (2.14)	9.28 (4.19)	
	Training	8.84 (3.70)	8.63 (5.55)	6.48 (1.81)	7.06 (3.01)	
	Treatment 1	8.12 (4.04)	8.93 (3.95)	6.07 (1.39)	6.74 (3.54)	
	Treatment 2	7.37 (4.16)	7.86 (3.77)	5.91 (2.15)	6.84 (3.05)	
	Follow-up I	7.84 (3.82)	8.34 (4.47	6.79 (2.43)	6.67 (4.21)	
	Follow-up II	9.95 (5.41)	6.14 (3.89)	5.35 (3.95)	5.57 (4.66)	
Headache intensity	Baseline	2.24 (0.87)	2.34 (0.69)	2.08 (0.45)	2.42 (0.78)	
	Training	2.76 (0.92)	2.21 (0.66)	1.91 (0.60)	2.24 (1.10)	
	Treatment 1	2.33 (1.05)	2.13 (0.64)	1.93 (0.53)	2.05 (1.12)	
	Treatment 2	2.44 (1.20)	2.25 (0.61)	1.73 (0.39)	2.10 (0.95)	
	Follow-up I	2.62 (1.19)	2.21 (0.68)	1.84 (0.40)	1.76 (0.92)	
	Follow-up II	2.56 (0.79)	2.17 (1.06)	1.83 (1.12)	1.61 (1.22)	
Medication	Baseline	1.74 (1.92)	1.35 (1.26)	1.97 (1.06)	1.01 (0.68)	
	Training	1.70 (1.66)	1.49 (1.88)	1.58 (1.11)	1.18 (1.19)	
	Treatment 1	1.61 (1.91)	1.27 (1.03)	1.77 (1.19)	0.73 (0.80)	
	Treatment 2	1.73 (1.79)	1.35 (1.19)	1.59 (1.04)	0.93 (1.04)	
	Follow-up I	1.79 (1.88)	1.16 (1.03)	1.38 (0.78)	0.56 (0.60)	
	Follow-up II	1.14 (1.25)	1.57 (2.22)	1.00 (1.50)	0.50 (0.76)	

*$P<0.05$; **$P<0.01$; ***$P<0.001$. *P Pleasant; R Response; S Stimulus; T Transformation*

The four groups received texts of equal length. The imagery instructions were read slowly to the patient who was requested to imagine the scenes vividly.

Statistical analysis

The following headache indexes were computed from the headache diary:

- pain intensity per hour with headache;
- headache frequency = number of days with headache per week;
- headache duration per day with headache; and
- number of days with medication use per week.

These indexes were computed separately for five intervals: baseline, training, first part of treatment (session 1 to 4), second part of treatment (session 5 to 9) and follow-up I. Treatment was divided into two blocks to show the anticipated gradual changes of headache activity more clearly.

Statistical analyses of these indexes, and the HPAL and PBL scores were conducted separately with a three-way (2x2x5) repeated measurement MANOVA. The between-group factors were cognitive strategy (pleasant versus transformative) and quality of information (stimulus versus response), and the repeated measures factor was time (baseline, training, treament phase 1, treatment phase 2 and follow-up I). A MANOVA was used because tests based on the MANOVA approach are free from sphericity assumptions, which are violated in most repeated measurement data (32). Afterwards simple main and simple interaction effects were computed.

Follow-up II data were analyzed separately because only 28 patients' data could be used.

Response ratings

Tape recordings of the response and stimulus training were rated for number of response-orientated sentences by four undergraduate students. They had been trained to identify response-oriented sentences but were not informed about the study in any other way. Only response sentences were inspected because all persons spontaneously reported a lot of stimulus information, while imaging response-oriented material was new to most and had to be learned (in the response groups). Mean inter-rater correlation was 0.94.

ANOVA was conducted using the mean number of response-oriented sentences as the dependent variable. The main effect – response versus stimulus – was significant ($F_{(1,36)}$=60.90; P≤0.000). Patients in both response groups used more response propositions than patients in the stimulus groups. There were no other significant effects. Thus, it was concluded that the training intervention was effective.

RESULTS

There were no significant differences between the baseline scores of the pain diary and pain questionnaires among the four groups. Comparison of the four treatment groups on the questionnaire of mental imagery revealed that patients in the imaginative transformation conditions group had lower scores on the 'imagery of bodily sensations' scale than patients in the pleasant imagery groups ($F_{(1,36)}$=5.0; P≤0.032). Thus, patients in the imaginative transformations group might have more difficulty with the treatment they were assigned to receive.

Treatment to follow-up I

Table 1 shows the means and SDs of the four headache indexes for the six measurements and the MANOVA results. Because the SP imagery group has somewhat higher baseline values in some variables, ANCOVA using the baseline values as covariants were conducted. Because these analyses rendered the same results as the MANOVAs and because the baseline differences are not significant, the MANOVA results are reported.

Headache frequency per week was significantly reduced because the main effect of the factor time and the linear trend were significant. There were substantial reductions in both groups treated with imaginative transformations (ST and RT), as seen in Figure 1A. The interaction of cognitive strategy and time was significant. The simple effects (Table 1) and the plots (Figure 1C) show that headache frequeny is reduced in the transformation conditions ST and RT. Within the follow-up I phase, headache frequency was significantly lower among patients who received imaginative transformation (groups ST and RT) compared with that in patients who received pleasant imagery (groups SP and RP) ($F_{(1,36)}$= 4.67; P≤0.037).

There were no significant effects of the response versus stimulus factor. As can be seen in Figures 1B and 1C, headache frequencies for the response versus stimulus conditions are the same throughout the study whereas the graphs for the pleasant versus transformative conditions drift apart. Headache intensity and duration, and medication use were not significantly reduced.

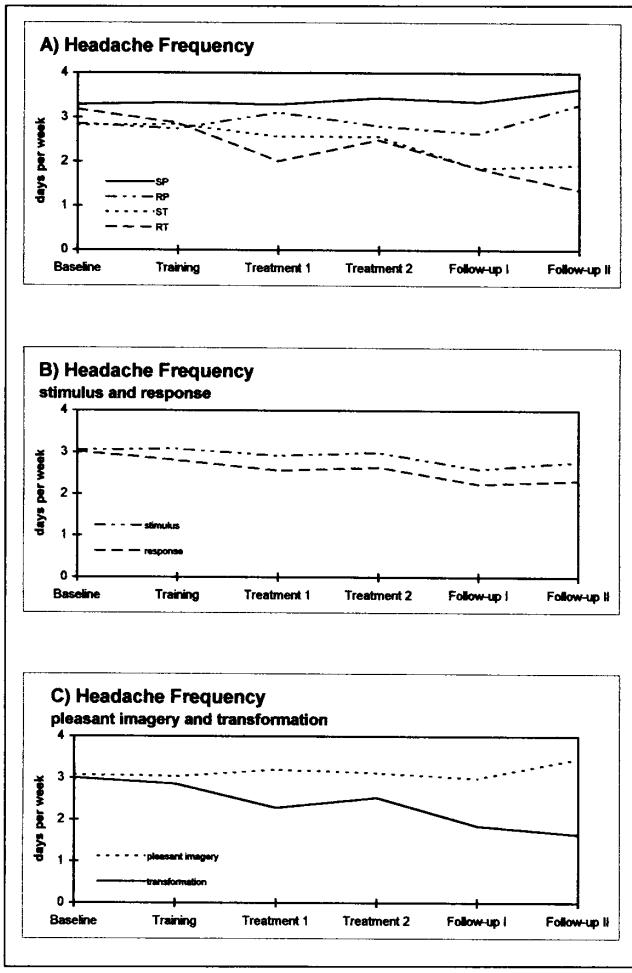

Figure 1) Mean headache frequency for the four groups (**A**) and for the stages of the factor quality of information (response versus stimulus) (**B**), and of the factor cognitive strategy (pleasant versus transformative) (**C**). 1st, 5th, 10th refer to the first, fifth and 10th treatment sessions. P Pleasant; R Response; S Stimulus; T Transformation

Means and SDs of the suffering scale of the HPAL are presented in Table 2. The graphs are presented in Figure 2. The main effect of the factor time and the linear trend are significant. There is a significant interaction between the factors cognitive strategy and time.

Looking at the simple effects (Table 2), the ST and RT groups again show greater reductions in suffering compared with the SP and RP groups (Figure 2C). Also, the response treatment conditions RP and RT are more effective than the stimulus conditions SP and ST, as can be seen in Figure 2B. Suffering scores are also reduced in the RP group. The two response conditions can be differentiated by a significant simple interaction effect, indicating that the reductions in the RT group are significantly greater than those in the RP group (Figure 2A).

There were no changes in the other scales of the HPAL during the course of the treatment. There were, however, small but significant reductions in the avoidance behaviour scale of the PBL for the entire sample (Table 2).

TABLE 2
Means, SDs and MANOVA results of the pain questionnaire variables

Variable	Measurement	SP mean (SD)	RP mean (SD)	ST mean (SD)	RT mean (SD)	MANOVA
Suffering (HPAL)	Baseline	53.9 (17.2)	51.8 (12.2)	49.8 (11.6)	47.5 (16.5)	Main effect time: $F_{(4,33)}=3.93$; $P\leq0.010$
	First treatment session	56.8 (18.9)	53.2 (15.0)	45.2 (12.4)	35.0 (19.8)	Linear trend: $F_{(1,39)}=15.49$; $P\leq0.000$
	Fifth treatment session	54.0 (16.1)	46.1 (12.5)	44.8 (15.8)	36.6 (18.6)	2-way interaction effect cognitive strategy x time: $F_{(4,33)}=3.37$; $P\leq0.020$
	10th treatment session	52.6 (17.2)	40.0 (15.1)	40.2 (13.4)	41.7 (21.4)	Simple main effect time within ST/RT: $F_{(4,33)}=5.01$; $P\leq0.003$
	Follow-up I	51.2 (17.7)	44.8 (19.8)	39.8 (16.7)	35.2 (19.0)	Simple main effect time within SP/RP: $F_{(4,33)}=3.43$; $P\leq0.019$
	Follow-up II	45.8 (20.2)	37.9 (22.1)	38.7 (13.9)	24.7 (15.9)	Simple interaction effect cognitive strategy x time within RP/RT: $F_{(4,33)}=3.97$; $P\leq0.010$
Avoidance (PBL)	Baseline	7.69 (3.58)	8.52 (4.32)	7.10 (2.14)	9.28 (4.19)	Main effect time: $F_{(4,33)}=3.56$; $P\leq0.016$
	First treatment session	8.84 (3.70)	8.63 (5.55)	6.48 (1.81)	7.06 (3.01)	Linear trend: $F_{(1,39)}=13.21$; $P\leq0.001$
	Fifth treatment session	8.12 (4.04)	8.93 (3.95)	6.07 (1.39)	6.74 (3.54)	
	10th treatment session	7.37 (4.16)	7.86 (3.77)	5.91 (2.15)	6.84 (3.05)	
	Follow-up I	7.84 (3.82)	8.34 (4.47)	6.79 (2.43)	6.67 (4.21)	
	Follow-up II	9.95 (5.41)	6.14 (3.89)	5.35 (3.95)	5.57 (4.66)	
Distraction (PBL)	Baseline	2.24 (0.87)	2.34 (0.69)	2.08 (0.45)	2.42 (0.78)	Main effect time: $F_{(4,33)}=3.59$; $P\leq0.015$
	First treatment session	2.76 (0.92)	2.21 (0.66)	1.91 (0.60)	2.24 (1.10)	Linear trend: $F_{(1,39)}=11.62$; $P\leq0.002$
	Fifth treatment session	2.33 (1.05)	2.13 (0.64)	1.93 (0.53)	2.05 (1.12)	
	10th Treatment session	2.44 (1.20)	2.25 (0.61)	1.73 (0.39)	2.10 (0.95)	
	Follow-up I	2.62 (1.19)	2.21 (0.68)	1.84 (0.40)	1.76 (0.92)	
	Follow-up II	2.56 (0.79)	2.17 (1.06)	1.83 (1.12)	1.61 (1.22)	

*$P<0.05$; **$P<0.01$; ***$P<0.001$. HPAL Hamburg Pain Adjective List; P Pleasant; PBL Pain Behaviour List; R Response; S Stimulus; T Transformation*

Patients of all treatment groups tend to use more distraction techniques after imagery instruction. As can be seen in Table 2, the increase in distraction technique use is also small.

Follow-up II: Eight months after the end of treatment 28 patients returned complete questionnaires and pain diaries.

An ANOVA revealed a significant main effect for the factor cognitive strategy for the variable headache frequency ($F[_{1,24}]=6.27$; $P\leq0.019$).

Table 1 and Figure 1 show that headache frequency is above baseline level for the pleasant imagery groups (SP and RP), while it is on or below the follow-up I level for the groups treated with imaginative transformations (ST and RT). There were no other significant differences among the four groups, which is probably due to the reduced sample size. Tables 1 and 2 show that the scores of the successfully treated groups did not deteriorate in the other variables.

DISCUSSION

In this study, imagery instructions with imaginative transformations suggesting a positive change resulted in a substantial and lasting reduction of headache frequency. Even though statistical analysis did not secure a general reduction in medication intake, Table 1 shows it to be highly improbable that treatment effects could be attributed to an increase in medication intake.

Significant differences in pain frequency reductions emerged between the imaginative transformations conditions and the pleasant imagery conditions. The same pattern emerged for the suffering scale of the HPAL. However, probably due to the small sample size, the differences in the suffering scale did not reach significance at the follow-up II stage eight months after treatment.

Contrary to our expectations, there were no effects for the other HPAL scales. A possible explanation is that the baseline values were low on these pain descriptor scales.

Pain intensity and pain duration were not influenced by treatment. Headaches occurred less frequently, but when they occurred they were as severe and lasted as long as they did before treatment.

Pleasant imagery did not lead to significant pain reductions. Only avoidance behaviour was reduced, and the use of distraction strategies was increased. However these changes were small.

One might argue that the transformation condition could have been more convincing for the patients. However, the rationale of the pleasant imagery conditions was more easily accepted, and patients had less difficulty in providing personal examples.

The differences between imaginative transformations and pleasant imagery can be explained by distraction or by a cognitive redefinition of pain experience. Distraction effects may be responsible for the success of the treatment with

imaginative transformations because the imaginative transformations may be more interesting than the pleasant imagery instructions. On the other hand, increases in the distraction scale of the PBL are too small to explain the marked reductions in pain frequency and are not limited to the successfully treated groups (Table 2).

The role of distraction is questioned within the literature on pain control. In their review on experimentally induced pain, McCaul and Malott (12) point out that redefinition strategies are more successful than distraction when higher pain intensities are involved. Eccleston (33,34) found that pain of higher intensities disrupts the successful processing and performance of the distraction task rather than vice versa. This means that higher intensity pain forces the individual to pay attention. Therefore, it is more appropriate to accept the existence of the pain and to redefine its emotional qualities. Leventhal (35) concluded that distraction strategies only work because they usually include a positive emotion or a suggestion incompatible with pain.

The results support the hypothesis that a cognitive redefinition is responsible for the treatment effects because only instructions to imagine a change in pain sensations and/or pain responses led to significant improvements. The fact that headache frequency was reduced while headache intensity and duration were unaffected, further supports this hypothesis: distraction can explain reductions in headache intensity and duration, ie, the patient gives less attention to his or her pain and so experiences less pain or even stops attending to the pain altogether. Redefinion works before the pain even starts by changing the general tendency to fear and expectation of pain attacks. Thus, it can be concluded that in this way headache frequency can be reduced. Further studies should address the role of distraction and cognitive redefinition.

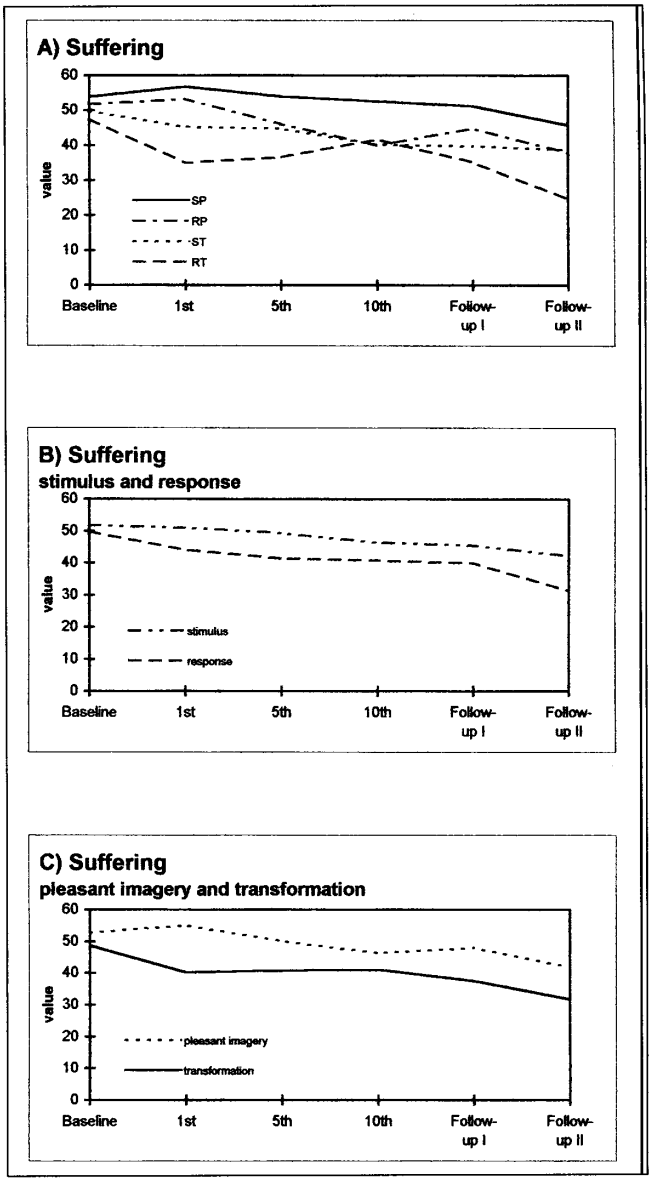

Figure 2) Means of the suffering scale of the Hamburg Pain Adjective List (HPAL) for the four groups (**A**) and for the stages of the factor quality of information (response versus stimulus) (**B**), and of the factor congitive strategy (pleasant versus transformation (**C**). 1st, 5th, 10th refer to the first, fifth and 10th treatment sessions. P Pleasant; R Response; S Stimulus; T Transformation

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