

A comparison of therapist-present or therapist-free delivery of very brief mindfulness and hypnosis for acute experimental pain

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The present experiment compared the effectiveness of seeing a therapist on DVD and face-to-face, in a laboratory-based acute pain experiment, using either hypnosis or mindfulness therapy as examples of psychological therapies. Two hundred and forty participants were recruited for a between subjects design. Participants were randomly assigned to one of four intervention groups: 1. Hypnosis face-to-face; 2. Hypnosis on DVD; 3. Mindfulness face-to-face; 4. Mindfulness on DVD. Pain tolerance times, subjective pain ratings, opinions on how helpful the technique was, how much it reduced pain, how enjoyable, anxiety reduction and willingness to do again were measured. Pain tolerance times and other results supported the use of psychological therapies on DVD as well as face-to-face, relative to the baseline condition and a control condition. Very brief interventions of both hypnosis and mindfulness were effective for acute pain management.

Keywords: acute pain, DVD, mindfulness, hypnosis, on-line therapies, psychological treatment

A pain experience is not a simple biological response to a stimulus. It is a complex interaction of biological, psychological and social factors (Melzack and Wall, 1965). Therefore, as well as using biological treatments for treating pain it may also be necessary to use other treatments, including psychological methods. Psychological treatments used for pain include distraction, relaxation, cognitive behavioural therapy (CBT), acceptance (ACT), hypnosis, and mindfulness.

Work done by the present research team has established that technological presentation of active distraction is an effective treatment for acute laboratory-induced pain (Jameson, Trevena and Swain, 2011). Distraction is perhaps the simplest of psychological methods, with little therapist skill involved in delivery. More sophisticated psychological therapies for pain include hypnosis and mindfulness training. These therapies

are both cognitive coping strategies. We have chosen these two therapies for the present experiment to represent popular psychological therapies. Although these therapies have a well-known lay meaning, findings in the literature are mixed, as there is widespread terminological inconsistency (Lynn, Martin and Frauman, 1996), meaning how much treatment, for how long, by whom, and its' specific components are not consistent.

Hypnosis is a brief cognitive behavioural technique, with no specific side-effects (Lynn et al, 1996; Rhue, Lynn and Kirsch, 1993). Hypnosis has long been used for its pain relieving qualities. A meta-analysis of hypnotically-induced analgesia found that hypnosis can produce moderate to large analgesic effects (Montgomery, DuHamel and Redd, 2000). These researchers also report that hypnosis is equally effective at reducing experimental and clinical

pain. A later meta-analysis indicated that the method of hypnotic induction (face-to-face vs audio tape) did not lead to any significant difference in pain outcomes (Montgomery et al, 2002). A more recent review has concluded that (for children and adolescents) hypnosis is at least as effective as distraction and is more effective than control conditions at managing pain related to treatment and tests (Accardi and Milling, 2009).

Conversely, mindfulness is a heightened awareness of the present moment. Mindfulness is also commonly used for the psychological treatment of chronic pain (Kabat-Zinn, 1982). Mindfulness both reduces the intensity of pain and increase mood, attention, sleep, well-being and general functioning (Baer, 2003; Morone et al, 2008; Palermo, 2009). Acceptance as a component of mindfulness has been found to be particularly useful for the management of pain (Palermo, 2009). Recent results using mindfulness for cold pressor pain found a mixed results, with one reporting a 12 minute mindfulness task not sufficient to increase tolerance time (Sharpe et al, 2009) and one using a 15 minute mindfulness task finding it was sufficient to increase pain tolerance (Liu et al, 2013).

While it is not clear exactly how either hypnosis or mindfulness therapies work to control pain, one possibility is that they may both train people to focus attention. Neurocognitive models of pain would suggest that pain demands a great deal of attention (LeGrain et al, 2009), so directing attention somewhere else might be a very effective way of dealing with an acute pain experience.

Hypnosis directly asks people to shift their attention while mindfulness pays some attention to the pain in a less emotional way.

While mindfulness and hypnosis are both effective for the treatment of pain, the problem remains of how to efficiently and economically administer the treatments. One option is to use DVD presentation of treatment, which has been found to work in several other medical fields. For example, the DVD presentation of CBT interventions has been found to reduce intensity and duration of hot flashes (Carpenter et al, 2007). Patient information presented via DVD has also been found to be useful and acceptable in cases of heart surgery (Steffinino et al, 2007), chemotherapy (Schofield et al, 2008), joint replacement surgery (Lewis, Gunta and Wong, 2002), and post surgical pain medication (Chen, Yeh and Yang, 2005). An audio recording was successfully used to present a mindfulness intervention for acute cold-pressor induced pain (Carpenter et al, 2007).

The present research sought to extend these findings and test solutions which may be applicable to “real world” acute pain settings. The following will test the hypotheses that 1) mindfulness and hypnosis interventions, even when only presented for 3 minutes, are effective acute pain reduction strategies in the laboratory setting, and 2) DVD recordings of expert therapists performing hypnosis or mindfulness will be as effective as seeing a therapist face-to-face.

MATERIALS AND METHODS

Participants

There were 240 participants with ages ranging from 18 to 38 years (121 females and 119 males) with a median age of 21 years ($SD = 2.98$ years). The participants were recruited through Student Job Search and consisted of students from the University of Otago and other tertiary providers. All participants received a NZ\$15 cash payment for their time. The experimental procedure and participant recruitment was reviewed and approved by the University of Otago Human Ethics Committee (ethical approval

reference 07/235).

Exclusion criteria. Before beginning the experiment, all participants were given a self-report checklist to indicate whether they had any health problems that might make it dangerous for them to participate. The participant’s agreement form specifically asked about circulatory problems, skin problems, painful conditions serious health problems. If participants indicated they had any of these problems they were not asked to participate in the experiment. Because of the way the experiment was set up (with the cold pressor situated to the left of the participant), only right-handed participants were asked to participate in the experiment.

Design

The experiment was conducted as a between-subjects design with 60 participants per group. Students were assigned to a group as they were referred by Student Job Search. Group order was randomised with each of the four groups being recruited twice during an eight month period. Thus therapists saw 30 people in one week, on two occasions, separated by several weeks/months. Therapists saw six people each day, at no more than two per hour. After an initial baseline exposure with no intervention, participants experienced one of four conditions: hypnosis face-to-face; hypnosis on DVD; mindfulness face-to-face or mindfulness on DVD.

Materials and Measures

Cold pressor. A Conthern Classic Series CAT 350-380 digital culture bath (cold pressor) was used to induce pain. The cold-pressor chilled a 20cm deep water-bath to two degrees Celsius (± 1 degree). A jug of warm water ($30^{\circ}\text{C} \pm 1$ degree) was provided for participants to warm their hand following each exposure to the cold water. A towel was also provided, so that the participant could dry their hands before completing the VAS scales after each task. The room was kept between 19 and 20°C .

Interventions. There were two therapists, one for the hypnosis intervention and one for the mindfulness intervention. Each therapist was experienced in their field and prepared a three minute script according to their professional standards. The scripts included specific instructions

eg. “when you place your hand in the cold water...” The therapist was filmed conducting this script, or repeated it from memory in the face-to-face conditions. Scripts were standard for the profession (please contact the author for further information).

Tolerance time. During both exposures to the water bath, the experimenter used a stop watch to record how long participants left their hand submerged from entry to withdrawal (tolerance time in seconds).

Visual Analogue Scale (VAS). After each exposure to the water bath, participants rated their pain levels and how interested they were in the task using visual analogue scales. For pain, participants were asked to rate how painful they found the task by making a mark on a 100mm line with ‘no pain’ at one end (0mm), and ‘most intense pain imaginable’ at the other end (100mm). Ratings were measured and recorded as mm from the 0mm end of the scale. The VAS has been demonstrated to be a reliable and consistent measure of clinical and experimental pain sensation (Price et al, 1994).

Final Questionnaire. At the completion of the experiment, participants answered a further four questions about their enjoyment, anxiety, pain, and how happy they would be doing the cold water immersion again, by circling a number between 1 (not at all/never) and 7 (very much/everyday) on a 7-point Likert scale.

Procedures

After reading the information sheet, completing the self-report checklist and consent form, and giving demographic information, participants took part in a baseline exposure with no intervention, by submerging their left hand up to their wrist in the cold water. The tolerance time was recorded, and the participant rated their pain and absorption. (Unknown to the participants, there was an upper time limit of two minutes after which they were asked to remove their hand from the cold water.) They were then either introduced to the therapist or watched the DVD of the therapist. The therapist left the room (if present). Immediately following hearing the script the participants were asked to again immerse their hand

Table 1 Demographic information for study participants

Age	Mean	21.05	21.38	20.75	21.02	21.03
	Sd	2.98	3.46	3.08	2.89	2.47
	range	18-38	18-34	18-38	18-33	18-29
Female gender	N	121	28	36	26	31
	%	50.4	46.7	60.0	43.3	51.7
Single marital status	N	168	44	48	37	39
	%	70.0	73.3	80.0	61.7	65.0
Student occupation	N	229	59	58	58	54
	%	95.4	98.3	96.7	96.7	90.0
European/Pakeha Ethnicity	N	183	50	39	51	43
	%	76.3	83.3	65.0	85.0	71.7

in the cold water bath (therapeutic exposure), repeated the ratings of pain and absorption, and then completed the final questionnaire.

Analysis

Data were collected on paper, and then entered into an Excel spreadsheet before being analysed using SPSS for Windows version v18.0. The hypothesis that DVD presentation of psychological therapies would be as effective as seeing the therapist face-to-face was examined using ANOVAs with between-subjects factors of therapy (hypnosis vs mindfulness) and administration (face-to-face vs. DVD), and within-subjects factor of task (baseline or therapeutic).

RESULTS

Control condition

A control condition using the same methods has been previously reported (see Jameson, Trevena and Swain, 2011). Participants' tolerance time for cold pressor at baseline was 57 seconds, following 2 minutes of television watching the participants again submerged their hand in the cold pressor. The second exposure had a mean tolerance time of 60 seconds. This was not statistically different from the baseline ($P > .01$, $n=60$). Temperatures of bath, environment, interval between test, instructions, and all other variables were the same as the present experiment. This indicates that there is a small and non-significant repetition effect. Control data has been included in Table 2 for comparison.

Table 1 shows the demographic information of participants overall and separately for each group.

Tolerance Time

Tolerance times were analysed using a mixed-design ANOVA with between-subjects factors of therapy (hypnosis vs mindfulness) and administration (face-to-face vs. DVD), and within-subjects factor of task (baseline or therapeutic: see Table 2).

Table 2. Means (and 95% confidence intervals) of pain tolerance times (in seconds), for baseline and therapeutic exposure to pain each of four groups (face-to-face mindfulness, face-to-face hypnosis, DVD mindfulness, DVD hypnosis: $n=60$ in each group)

	Presentation	Baseline	Therapeutic
Mindfulness	DVD	57.70 (47.99 - 67.41)	79.00 (69.26 - 88.74)
	Face-to-face	58.92 (49.21 - 68.63)	84.85 (75.11 - 94.59)
Hypnosis	DVD	52.65 (42.94 - 62.36)	77.72 (67.98 - 87.45)
	Face-to-face	62.62 (52.91 - 72.33)	84.85 (75.11 - 94.59)
Control*	TV	56.93	60.45
Overall**		57.97 (53.12 - 62.83)	81.60 (76.74 - 86.47)

Note.

*From Jameson, Trevena and Swain (2011) $n=60$

** does not include control condition

On average, tolerance time was longer in the therapeutic condition (81.60 seconds) than the baseline (57.97 seconds), and this difference was statistically significant ($F(1,236)=205.20$, $p < 0.001$). However, none of the other comparisons were statistically significant. Specifically, the tolerance time was the same for both therapies ($F(1,236)=0.02$, $p=0.888$), method of administration ($F(1,236)=1.69$, $p=0.20$). There was no interaction between therapist and administration ($F(1,236)=0.29$, $p=0.59$), and the increase in tolerance time from baseline to therapeutic session did not depend on therapist, mode of

administration, or the interaction (all $ps > 0.19$: see Table 2 for means and 95% confidence intervals)

Checking for ceiling effect on tolerance time

There were 51 people (21.3% of participants) who kept their hands in

the water for the maximum time of two minutes during the baseline task, and were asked to stop. (During the therapeutic task, 101 people (42.1%) reached the maximum time.) To ensure that our results were not affected by a ceiling effect on tolerance time, the above analysis was repeated without the 51 people who reached the time limit at the baseline condition (see Table 3). On average, tolerance time was longer in the therapeutic condition (71.22 seconds) than the baseline (41.24 seconds), and this difference was statistically significant ($F(1,185)=265.47$, $p < 0.001$). There was a non-significant trend for

Table 3. Means (and 95% confidence intervals) of pain tolerance times (in seconds), for baseline and therapeutic exposure to pain each of four groups (face-to-face mindfulness, face-to-face hypnosis, DVD mindfulness, DVD hypnosis), excluding participants who reached two minutes at baseline.

	Presentation	Baseline	Therapeutic
Mindfulness	DVD (n=47)	40.47 (33.93-47.01)	67.66 (57.08-78.24)
	Face-to-face (n=49)	45.20 (38.80-51.610)	76.96 (66.60-87.32)
Hypnosis	DVD (n=48)	35.81 (29.34-42.28)	67.15 (56.68-77.61)
	Face-to-face (n=45)	43.49 (36.81-50.17)	73.13 (62.33-83.94)
Overall	(n=189)	41.24 (37.98-44.51)	71.22 (65.95-76.50)

tolerances to be longer for face-to-face interactions than for DVD administration ($F(1,185)=2.93$, $p=0.089$). None of the other comparisons approached significance: tolerance time was the same for both therapies ($F(1,185)=0.04$, $p=0.509$), there was no interaction between therapist and administration ($F(1,185)=0.001$, $p=0.982$), and the increase in tolerance time from baseline to therapeutic session did not depend on therapy, mode of administration, or the interaction (all $ps>0.39$). As the results were not different from analyses with all participants, subsequent analyses were conducted on the whole sample.

Subjective Pain Scores

Table 4 shows pain scores measured using the VAS after each cold pressor condition. Scores were collected by measuring the distance (mm) from 0 (labelled "no pain") to where the participants made a mark on the 100mm line (labelled "most intense pain imaginable"), after both the baseline and the therapeutic task.

Pain scores were significantly lower for the therapeutic task than

for the baseline task (44.90 to 48.66, $F(1,236)=20.29$, $p<0.001$), and the difference between tasks was greater for Hypnosis (43.64 to 49.74) than for Mindfulness (46.15 to 47.58, $F(1,236)=7.79$, $p<0.01$ for the task by therapist interaction). There was also a non-significant trend for pain reports to be lower for face-to-face interactions (44.78) than for DVD (48.78, $F(1,236)=2.92$, $p<0.089$). None of the other comparisons approached significance (all $ps>0.4$).

Helpfulness of the technique

Responses to the question "How helpful did you find the technique?" were analysed using a mixed-design ANOVA with between-subjects factors of therapist (hypnosis vs mindfulness) and administration (face-to-face vs. DVD). The perceived helpfulness did not depend on the therapy, the mode of administration, or the interaction between them (all $ps>0.14$: see Table 5).

Subjective pain reduction

Scores for "How much did the technique reduce pain?" (where

1=not at all and 7=very much) were analysed using a mixed-design ANOVA with between-subjects factors of therapy (hypnosis vs mindfulness) and administration (face-to-face vs. DVD). The perceived reduction in pain did not depend on the therapy, the mode of administration, or the interaction between them (all $ps>0.2$: see Table 5)

Enjoyment

Likert enjoyment scores were analysed using a mixed-design ANOVA with between-subjects factors of therapy (hypnosis vs mindfulness) and administration (face-to-face vs. DVD), and within-subjects factor of task (baseline or therapeutic). Enjoyment was greater face-to-face (5.00, 95% CI 4.83-5.18) than for the DVD (4.64, 95% CI 4.46-4.82, $F(1,236)=7.919$, $p=0.005$). There were no other significant differences.

Anxiety

Likert anxiety scores were analysed using a mixed-design ANOVA with between-subjects factors of therapist (hypnosis vs mindfulness) and

Table 4. Mean Subjective Pain Scores (with 95% confidence intervals) measured on VAS (n=240) in mm

	Presentation	Baseline	Therapeutic
Mindfulness	DVD	48.22(43.57-52.87)	47.67 (42.55-52.78)
	Face-to-face	46.95 (42.30-51.60)	44.63 (39.52-49.75)
Hypnosis	DVD	52.57 (47.92-57.22)	46.65(41.54-51.76)
	Face-to-face	46.92 (42.27-51.57)	40.63(35.52-45.75)
Overall		48.66(46.34-50.99)	44.90(42.34-47.45)

Table 5. Mean responses to the questions: "How helpful did you find the technique?" (VAS, 0-100mm) and "How much did it reduce the pain?" (Likert 1-7) with 95% Confidence Intervals in brackets

	Mindfulness face-to-face	Mindfulness DVD	Hypnosis face-to- face	Hypnosis DVD	Overall
"How helpful did you find the technique?" (VAS, 0-100mm)	49.48 (43.43 - 55.53)	48.53 (42.48- 54.58)	54.55 (48.50- 60.60)	52.42 (46.37- 58.47)	51.25 (48.22- 54.27)
"How much did it reduce the pain?" (Likert 1-7)	4.10 (3.70-4.50)	3.67 (3.27-4.06)	4.13 (3.74- 4.53)	4.15 (3.75- 4.55)	4.01 (3.82- 4.21)

administration (face-to-face vs. DVD), and within-subjects factor of task (baseline or therapeutic).

Anxiety was higher for the baseline (3.63) than for the therapeutic condition (3.05, $F(1,236) = 23.466$, $p < 0.00$). The difference between tasks was more pronounced for hypnosis (3.72 to 2.89) than for mindfulness (3.55 to 3.22, $F(1,236) = 4.228$, $p < 0.05$ for interaction between task and therapist). None of the other comparisons was significant.

Happy to do again with/without help

Likert scores for reported readiness to repeat the water immersion were analysed using a mixed-design ANOVA with between-subjects factors of therapy (hypnosis vs mindfulness) and administration (face-to-face vs. DVD), and within-subjects factor of help (with or without the DVD/therapist). The readiness to do the task again was much greater for "with the therapist/DVD" (5.28) than for without (4.83, $F(1,236) = 24.680$, $p < 0.001$). There were no main effects of therapy, mode of administration, or the interaction between the two (all $ps > 0.8$) and the effect of help also did not differ across therapy, mode of administration, or the interaction between the two (all $ps > 0.15$).

DISCUSSION

The present results provide evidence for hypnosis and mindfulness being effective therapies for the reduction of an acute pain experience in the laboratory. This is consistent with neurocognitive models of pain, stating that pain competes for attention (Steffinino, 2007). Additionally, the results confirm

the hypothesis that DVD presentation of psychological pain therapies has similar effects on acute pain as face-to-face therapy. Specifically, tolerance times for pain were significantly longer when participants were given either intervention. The lengths of time that the pain could be tolerated were equally extended by mindfulness on DVD and face-to-face, and hypnosis on DVD and face-to-face administrations of therapy. However, the subjective experience of pain was not reduced by each of the interventions equally: participants reported less pain with hypnosis than mindfulness (using VAS pain scores). This result might be expected as mindfulness asks participants to examine the pain and feel it whilst accepting it; in contrast, hypnosis directs attention away from pain.

Interestingly, on a subjective question participants reported around a fifty percent reduction in pain for both interventions relative to the baseline, and if they were asked to do the task again most people would choose to have the intervention they were given instead of no intervention. "Enjoyment" was rated as higher for face-to-face interventions than DVD: although pain experience and tolerance times were not improved by seeing the therapist face-to-face, people seem to enjoy having a therapist present. Hypnosis provided a greater reduction in task anxiety than mindfulness. Addition of control data from a previous study show that the effect is not simply the results of repeated trials. The participants in previous research ($n=60$) showed a slight increase of reported pain in the cold-pressor test after a second administration under similar conditions

(Jameson, Trevena & Swain, 2011).

These results support the literature on hypnosis and mindfulness's ability to reduce a person's experience of acute pain (Montgomery et al, 2000; Kabat-Zinn, 1982; Carpenter et al, 2007; Zeidan et al, 2010). This research adds to that body of work with the finding that those therapies can be presented therapist-free with very little reduction of the pain-relieving power. This finding will allow psychological treatments to be used more easily in clinical settings, instead of being confined to the laboratory.

When considering a treatment for clinical use we must consider clinical significance as well as statistical significance. Previous studies suggest that the minimum change in a VAS score for pain to have clinical significance is between 9mm (Todd, 1996) and 13mm (Kelly, 1998). The VAS change scores reported in the present study are in the range of 0.6 mm (mindfulness on DVD) to 6.29 mm (hypnosis face-to-face) and they therefore may not represent clinically significant changes in pain perception. This means that either of these therapies (hypnosis or mindfulness) in either presentation (DVD or face-to-face) would need to be developed further to have an important effect on acute clinical pain. Longer interventions may fulfil this challenge.

The authors also note that the therapists may have done a better job face-to-face if allowed to vary from the script. Small variations were observed in the behaviour of the therapists when face-to-face such as modelling of body language, social smile, pacing and

handshake. Although the therapists' words were the same face-to-face as on DVD, some tailoring to clients still occurred. In an unrestricted trial, where therapist could vary the script it may be possible for some skilled therapists to do better face-to-face than via DVD presentation. Also, notably all previous interventions have had much longer than a three-minute intervention (Sharpe et al, 2010; Carpenter et al, 2007; Kelly, 1998). The present findings provides an interesting addition to the literature that even an extremely brief intervention can be effective.

Any clinical value of these interventions is not established and this issue requires further testing. Another limitation in this study is the order effect: the baseline condition was always before the therapeutic condition, so that the increased tolerance time may be due to familiarity with the sensations. However, a previous study in this laboratory has shown that repetition of the cold pressor task does not lead to statistically significantly increased tolerance time (Jameson, Tevena and Swain, 2011). Data has been presented in tables to support this claim.

Another possible limitation of this research is the choice of therapists. No objective data exists on their absolute skill level, which may have varied and the effect of their treatment was not measured. This type of problem can be considered realistic of a clinical setting where an expert will be relied upon. Care was taken in the choice of therapist but skill level is unknown. We also note that the participants in this study were tertiary students, therefore the generalizability to a wider population is speculative.

These findings suggest useful psychological interventions for acute pain are possible. There is very little previous evidence that very short interventions can be effective for acute pain. Apps and computer-based technologies are constantly being developed as treatment for pain, as well as many other disorders. Yet, evidence that technological versions of established therapies are effective is lacking. This research goes some way to filling that evidence gap. It suggests that therapies effective in the hands of skilled practitioners may also be effective

delivered in an on-line environment. Thus, we may be able to generalise that various psychological in-person therapies could be delivered effectively using technology.

In conclusion, the present hypotheses were confirmed: that a very short intervention of hypnosis or mindfulness can be effective for acute pain treatment. Secondly, DVD presentation of therapists are similarly effective as face-to-face with therapists in this scenario. This work opens the possibility of a multimedia intervention being developed for use in mild to moderate acute pains settings. Therapist-free presentations of psychological therapies should be tested in clinical settings to confirm that the results of this experiment are replicable and acceptable in clinical situations.

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