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SSC 319 Senior Thesis

The Precebo illusion of pain analgesia using the cold pressor task

Supervisor: Dr. Victoria Yeung Wai Lam

Name: Kam Man Chun

Everybody feels physical pain at some time in their life. Although physical pain can protect us from seriously harming ourselves, pain can also be harmful. Studies have revealed that unrelieved pain can have a long lasting harmful effect on both physical and psychological health (Australian and New Zealand College of Anaesthetists, 2006). Therefore, pain analgesia has long been an important issue in various fields, such as medical, biological and psychological field. In the current study, pain analgesia was studied through a psychological phenomenon called precebo illusion.

1. Literature review

Have you ever felt more knowledgeable after borrowing a book from library even not started to read? This illusory feeling of already benefited from an unused product is called a precebo illusion, which can be defined as a self-deceptive belief that an individual perceive themselves already benefited from a mere possessed object even without utilizing it (Yeung, Loughnan, Kashima, Lun & Tsuchiya, 2012; Yeung, Kashima, Lun & Loughnan, 2014).

Previous studies on precebo illusion suggested that a mere possession of objects can influence possessor's perception (Yeung et al., 2012, 2014). Studies result demonstrated that a mere possession of learning materials can induce an illusion in students to perceive themselves as more knowledgeable in a particular topic (Yeung et al., 2012). Moreover, a mere possession of a relaxation ball can reduce possessor's perceived stress (Yeung et al, 2014). In the current study, it is argued that precebo illusion can also influence possessor's perceived physical pain.

Having psychological effects from a mere possession of object is not a new discovery. Numerous studies have revealed that people tend to associate themselves to their possessed object (Beggan, 1992). Due to the strong association between the self

and possessed object, the possessions of objects can even be considered as part of the extended self (Nesselroade, Beggan & Allison, 1999). Furthermore, the association between the self and possessed object can lead to some psychological effects. One of the effects from mere possession of an object is called mere ownership effect, which suggested that people tend to value a possessed object higher than an identical object that they do not possess (Beggan, 1992). Moreover, people not only value their possessed object more, but also perceive their possessed object as more attractive (Beggan, 1992). According to Beggan (1992), the mere ownership effect is a result of people associates themselves with the possessed object. Since people generally tend to view themselves in a favorable manner (Nesselroade et al., 1999), the object is viewed as more favorable once it is associated with them.

In the current study, it is proposed that having a possession of an object not only affects the perception of the object itself, but also influence possessors to perceive themselves as already obtained the expected benefit of using the objects even though the object is actually unused.

Placebo effect and precebo illusion

Precebo illusion can be surmised as a component of placebo effect (Yeung et al., 2014). Placebo effect is a psychological phenomenon that patients having an actual or perceived improvement after a sham treatment (Stohler & Zubieta, 2009). While placebo effect occurs after people having the possession and utilization of the object (or the treatment), precebo illusion occurs when people perceived themselves as if they had already obtained the expected benefit of an object after they possessed it. Yeung et al., (2014) argued that precebo illusion could be a precursor of a placebo effect, which occurs once people having a mere possession of a placebo. As a result, it

is surmised that both precebo illusion and placebo effect are having a similar underlying mechanism, which is motive-expectation concordance.

Mechanism: Motive-expectation concordance

It is proposed that precebo illusion will occur only when one's motive is congruent with the expectation of possessed object. According to Moerman and Jona (2002), placebo effect should be examined as a kind of 'meaning response'. 'Meaning response' is the effect of people's expectation, which is defined as the psychological or physiological effect resulting from the meaning that attached with the treatment (Moerman & Jona, 2002). In other words, placebo effect can be considered as a response to the individual's expectation (meaning) of a placebo, instead of a response to the inert placebo itself. This suggested that placebo expectation is one of the fundamental elements in placebo effect. In a study of placebo effect, the effect of both active and inert drug is enhanced by the presence of a brand name label, which showed that having a higher expectation of drugs can enhance the effect of drugs (Moerman & Jona, 2002). In a study of placebo effect in aerobic exercise, a group of participants was told that the exercise can enhance both psychological well-being and aerobic capacity. While another group of participants were told that the exercise can enhance aerobic capacity only. Aerobic capacity is enhanced in both of the groups, but only the participants from the first exercise group improved the psychological well-being (Moerman & Jona, 2002), which again demonstrated the importance of expectation in placebo effect.

Having a desirable expectation of treatment can lead to placebo effect. Conversely, having an undesirable expectation can lead to nocebo effect, which is a phenomenon that an expectation of undesirable outcome (e.g. sickness) actually lead

to the undesirable outcome of the expectant (Hahn, 1997). In a study of nocebo effect (Enck & Hauser, 2012), half of the participants were told that the drug could cause an erectile dysfunction effect, while the other participants were not informed. 44% of the informed participants reported that they experience erectile dysfunction, while only 15% of the uninformed participants report experience erectile dysfunction. Furthermore, in Yeung et al., (2012, 2014) precebo studies, it was discovered that having a high expectation on an object is related to the occurrence of the precebo illusion. For example, having a high expectation that the relaxation ball can effectively induce relaxation is related to the occurrence of precebo illusion of stress reduction.

Although expectation is one of the essential factors of placebo effect, it is not the single factor that contributes to placebo effect (Benedetti, Finniss & Price, 2008). As motivation is influencing human perception, it is also likely to contribute to placebo effect (Chung, Price & Robinson, 2005). Moreover, studies have also demonstrated that the desire of pain relief can contribute to placebo analgesia (Price et al, 2003), which suggested that motivation is also an important element in placebo effect.

Numerous studies have concluded that placebo effect is likely to occur when the placebo expectation is associated with a compatible goal (Geers et al, 2005). On the contrary, if the individual has a placebo-incompatible goal, the placebo expectation is more likely to be discarded and lead to a weaker or no placebo effect. In other words, whether motivation is congruence with placebo expectation is essential in placebo effect. Therefore, the congruence between motivation and expectation would also be an important factor in precebo illusion.

In addition, it is likely that when one's motive or goal is congruent with the expectation of possessed object, the possessor will feel empowered to achieve the

goal. As a result, the perceived control and self-efficacy would be enhanced when a person possesses a motive-expectation concordance object. Since numerous studies have clearly demonstrated that both perceived control and self-efficacy beliefs are vital in the perception and experience of pain (Vancleef & Peters, 2011), it is proposed that the possession of a high expectation pain relieving cream can create an analgesic placebo illusion when there is a concordant motive.

Other potential factors of placebo illusion

(1) State anxiety

As placebo illusion is investigated through pain analgesia in the current study. It is also necessary to examine other psychological factors of pain perception.

Emotions are one of the psychological factors that affect pain perception. The effect of emotions on pain perception is recognized although the underlying mechanisms remain unclear (Loggia, Schweinhardt, Villemure & Bushnell, 2008). Among various emotions, numerous studies have focus on the effect of pain related state anxiety on pain perception (Loggia et al., 2008). According to Loggia et al. (2008), a study conducted in dental environment showed that preoperative anxiety is positively correlated with postoperative pain immediately after the oral surgery. Some of the scholars argued that attention mediates the influence of anxiety on pain perception (Arntz, Dreessen & Merckelbach, 1991), while pain related state anxiety direct the attention of people towards pain.

Apart from the pain related state anxiety, personality traits can also affect placebo effect and pain perception. By reviewing from the past studies, some personality traits that related to placebo analgesia and pain perception are listed below. These variables are also speculated to be related to the placebo illusion of pain analgesia.

(2) Dispositional optimism

Dispositional Optimism can be defined as a relatively stable expectancy for negative or positive outcomes (Jakšić, Aukst-Margetić & Jakovljević, 2013). As optimistic people tend to have attentional bias for positive information, optimism can serve as a moderator of placebo effect by affecting the placebo expectation (Jakšić, Aukst-Margetić & Jakovljević, 2013). Moreover, a study conducted by Geers et al (2010) also suggested that placebo analgesia can be predicted by dispositional optimism.

(3) Desire of control

The desire of control of a person would moderate the placebo effect. Studies conducted by Geers et al (2013) showed that patients with high desire for control had a larger placebo analgesic effect if they were able to choose their treatment. This suggested that desire of control can also influence placebo analgesia in some circumstances. In the current study, participants' desire of control was investigated.

(4) Suggestibility

Suggestibility is another personality trait that contributes to the placebo effect. According to De Pascalis et al (2002), highly suggestible people would have a high expectancy for medicine efficacy when they received suggestions about the medicine. In the same study, individual differences in suggestibility were also found to have a significant contribution to the magnitude of placebo analgesia. Since people with high suggestibility are more likely to accept suggestions, they are easier to generate a high placebo expectation. As a result, they are more likely to experience placebo effect.

(5) Trait anxiety

As mentioned before, pain related state anxiety can affect the pain perception of people. Trait anxiety refers to a stable susceptibility to experience state anxiety (Grös, 2007), which can also be regarded as a personality traits that influence pain perception. In other words, people with a high trait anxiety are more likely to generate pain related state anxiety when they are exposed to pain stimulus.

(6) Fear of pain

Fear of pain is also found to have a negative correlation with placebo analgesia. A study conducted by Lyby, Aslaksen and Flaten (2011) suggested that fear of pain can reduce electrophysiological and subjective placebo analgesic responses. In addition, past studies reported that fear of pain is a factor that affect placebo analgesia (Flaten, 2013). In the current study, participants' fear of pain of people was also examined.

Based on the motive-expectation concordance mechanism. It was expected that if participants possess a pain relief cream that they expected to be effective and have a high motivation to reduce pain, they would perceived to have less physical pain. Hypothesis 1 and 2 are therefore developed:

H1: When participants hold a high motive to reduce pain, participants in the possession condition should report a lower perceived pain that participants in the non-possession condition.

H2: When participants hold a low motive to reduce pain, regardless of whether they possess a pain relief cream or not, their perceived pain would not differ significantly.

As mentioned previous, there are some potential factors that expected to affect the precebo illusion of pain analgesia. Hypothesis 3 and 4 are therefore developed:

H3: The following factors will be positeively correlated with the precebo illusion of pain analgesia.

- (a): *Dispositional optimism*
- (b): *Desire of control*
- (c): *Suggestibility*

H4: The following factors will be negatively correlated with the precebo illusion of pain analgesia.

- (a): *State anxiety*
- (b): *Fear of pain*

The Cold pressor task

In the current study, the cold pressor task was used to induce physical pain. In the cold pressor task, participants were required to immerse their hand in cold water for a period of time. During the immersion, participants would experience a gradually increasing pain during the cold pressor task (Koenig, Jarczok, Ellis, Bach, Thayer & Hillecke, 2013).The cold pressor task have demonstrated excellent reliability in producing physical pain for measuring pain threshold and pain tolerance according to a 2-week test–retest Study (Koenig et al., 2013). According to a study of cold pressor task (Stewart & James, 1941), the intensity of pain is the highest when the hand is immersed in cold water for 1 minute. Adaptation will occur after 1 minute and the pain will become less intense afterward. Another study of physical pain sensitivity showed that the mean immersion time of Hong Kong Chinese in a 5°C cold pressor task was around 90 second (Chan et al., 2013). In the current study, following past research, participants were asked to immerse their hand in a 5°C cold pressor task for 1 minute.

Overview of Studies

There were three studies conducted in total. The first two studies were pilot studies, which aimed at validating the experimental materials that were used in the main study.

The third study was the main study, which contained two phases. In the first phase, participants were required to conduct an online survey. In the second phase, participants were required to join an experiment in a psychology laboratory

2. Methodology

2.1 Pilot Study I

The aims of pilot study I was to examine the effectiveness of two experimental materials. First, to examine the effect of a designed fictitious article which aims at to manipulating participants' motive to reduce pain. Second, to examine the effect of a designed fictitious leaflet that aims at generating a high expectation of the pain relief cream to the participants.

2.1.1 Participants and procedure

Eight participants (4 males; 4 females) were invited to participate in the pilot study I without any incentive. Participants were first given a cover story which briefly describes the study. In the cover story, they were told that the current study is aim at investigating the pain perception of Asian. Also, participants were told that the study is still in the preparation stage that they were not required to participate in any pain perception test. After that, they were asked to read an article, which aims at manipulating their motivation to reduce pain. There are two versions of the article, one of them was to induce a high motive to reduce pain and the other version was to induce a low motive to reduce pain. Different versions of the article were randomly given to participants. They were asked to answer a list of question which located at the back of the article in order to check the effect of the manipulation and their

understanding of article. Next, they were asked to read a counterfeit leaflet about a pain relief cream, which aimed at inducing a high expectation of the effectiveness of the counterfeit pain relieving cream. Participants were asked to answer a list of questions which aimed at checking their expectation of the effectiveness of the pain relief cream.

2.1.2 Result

In general, participants who read the high motive version article reported having a higher motivation to reduce pain ($M = 4.4$, $SD = .85$) compared with participants who read the low motive version article ($M = 4.2$, $SD = .43$). However, the difference was not significant, $t(6) = .42$, $p = .689$. Also, the measurement of motivation to reduce pain was found to have an unacceptable internal consistency (Cronbach's $\alpha = .14$).

On average, participants showed an acceptable expectation of the effectiveness of the pain relieving cream on a 7-point scale. ($M = 5.19$, $SD = .69$). Moreover, the measurement of expectation of the effectiveness of the pain relieving cream was found to have a good internal consistency (Cronbach's $\alpha = .77$).

2.1.3 Discussion

After analyzing the answers of questions regarding article and interviewed some of the participants, the insignificant difference in motivation can be attributed to the misunderstanding of the designed article. The readability of the article and the corresponding questions were needed to be improved. Therefore, in the main study, some adjustments of the wordings of the articles were made. First, several distracting technical terms were removed. Second, part of the paragraph was changed to point form instead of long paragraphs. Third, key words in the questions were highlighted in order to prevent the misunderstanding of questions.

The content of the leaflet was remained unchanged since it showed a favorable effect in inducing an acceptable expectation of the pain relief cream.

2.2 Pilot Study II

The aim of pilot study II was to use another group of participants to validate the effect of the materials after adjustment

2.2.1 Participants and procedure

Eight participants (3 male; 5 female) were invited to participate in pilot study II without any incentive. Participants who participated in pilot study I were not invited to participate in pilot study II. Participants were told that the current study is aim at investigating the pain coping strategy of Asians. After that, they were asked to read the revised article, which aimed at manipulating their motivation to reduce pain. Again, there were two version of the article, one of them was to induce a high motive to reduce pain and the other version was to induce a low motive to reduce pain. Different versions of the revised article were randomly given to participants. They were asked to answer a list of questions which were located at the end of the article in order to check the manipulation effect of the article and also the participants' understanding of the article.

2.2.2 Result

On average, participants who read the high motive version of the revised article did report a significantly had a higher motivate to reduce pain ($M = 6.50, SD = 1.06$) compared with participants who read the low motive version ($M = 4.85, SD = .71$), $t(6) = 2.57, p = .042$.

The items used to measure the motivation to reduce pain was found to have a good internal consistency (Cronbach's $\alpha = .78$).

2.2.3 Discussion

According to the results, the effect of the revised articles in manipulating participant's motivation to reduce pain is favorable. The articles then were adopted in the main study. In order to further enhance the articles' readability, minor adjustments on the format were further made.

2.3 Current Study

The aims of the current study are: First, demonstrate a precebo illusion through pain analgesia; Second, validate the motive-expectation concordance mechanism of precebo illusion; Third, investigate the effect of personality traits on precebo illusion.

2.3.1 Participants

Fifty-seven Lingnan students (12 males, 45 females, $M_{age} = 21.4$, $SD = 2$) were recruited to participate in the study. Part of the recruited participants joined the study to fulfill their course requirement. While some of the participants were recruited through the personal network of the researcher without any incentive. Participants were required to have basic Chinese reading ability. An informed consent was obtained from each participant before the study.

2.3.2 Design

The experimental design of the current study is illustrated in the following 2 X 2 table. Participants were randomly assigned to one of the four conditions. The current design had 2 IV (motivation to reduce pain; possession status), and 1 DV (self-reported pain perception)

	High motivation to reduce pain	Low motivation to reduce pain
Possession of pain relieving cream	Possession-high motive condition	Possession-low motive condition
Non possession of pain relieving cream	Non possession-high motive condition	Non possession-low motive condition

2.3.3 Measurement

The following measurement scales were used to measure the personality traits, perceived pain and state anxiety of participants. All measurement scales were translated into Chinese in the current study.

6-item Chinese Revised Life Orientation Test (CLOT-R)

The 6-item Chinese Revised Life Orientation Test (Lai, Cheung & Yu, 1998) is a self-report rating test that measures dispositional optimism. The Chinese revised test is based on the 10-item Revised Life Orientation Test (Scheier, Carver & Bridges, 1994) to measure the dispositional optimism among Chinese. The test has shown to have an adequate measure of dispositional optimism among Hong Kong Chinese subjects (Lai et al., 1998). The test consists of 6 items. Half of the items were positively worded (e.g. "In uncertain times, I usually expect the best.") and half of the items were negatively worded (e.g. "I hardly ever expect things to go my way."). Participants were required to indicate their extent of agreement to each of the items on a 7-point scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). For the current sample, the test showed a good internal consistency (Cronbach's $\alpha = 0.76$).

Desirability of Control scale (DCS)

Desirability of Control scale (Burger & Cooper, 1979) is a self-report rating scale that measures desire for control. The scale consists of 20 items. Three of them were excluded since they are not applicable to the recruited participants (e.g. "When driving, I try to avoid putting myself in a situation that I could be hurt by someone else's mistake"). For the remaining items, 5 of them were negatively worded (e.g. "I would rather someone else take over the leadership role when I'm involved in a group project.") and 12 of them were positively worded (e.g. "I enjoy making my own

decisions.”). Participants were asked to indicate their extent of agreement to the items on a 7-point scale ranging from 1 (The statement does not apply to me at all) to 7 (The statement always applies to me). The scale showed a good internal consistent (Cronbach's $\alpha = 0.86$) for the current sample.

Short Suggestibility Scale (SSS)

Short Suggestibility Scale (Kotov, Bellman & Watson, 2004). is a self-report subscale of the Multidimensional Iowa Suggestibility Scale that measures suggestibility. The Short Suggestibility Scale consist of 21 items (e.g. “I can be influenced by a good commercial.”), participants were asked to indicate the extent of items that apply on them on a 5-point scale ranging from 1(not at all or very slightly) to 5(a lot). For the current sample, the Short Suggestibility Scale showed a good internal consistent (Cronbach's $\alpha = 0.86$).

State-Trait Anxiety Inventory, Trait Anxiety Subscale (STAI-Y2)

The trait Anxiety Subscale of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).is a self-report rating scale that measure trait anxiety. The subscale consists of 20 items that people usually used to describe themselves. Nine of the items were negatively worded (e.g. “I lack of self-confidence”) and 11 of the items were positively worded (e.g. “I am happy”). Participants were required to indicate how the statement can apply to them in general on a 4-point scale ranging from 1(Almost never) to 4(Almost always). The Trait Anxiety Subscale showed a good internal consistency (Cronbach's $\alpha = 0.88$) in the current sample.

Fear of Pain Questionnaire -III (FOPQ-III)

Fear of Pain Questionnaire -III (McNeil & Rainwater, 1998) is a self-report rating scale that measures the fear of pain. The questionnaire aims at assess the fear of individual towards three broad categories of pain include severe pain, minor pain and medical pain. The questionnaire consists of 30 items that describe painful events (e.g. “Biting your tongue while eating”). Participants were asked to report their fear of pain of the described painful events on a 5-point scale ranging from 1(Not at all) to 5(Extreme). For the current sample, the Fear of Pain Questionnaire –III showed an excellent internal consistency (Cronbach's $\alpha = 0.93$).

Visual analogue scales (VAS)

Visual analogue scales (VAS) were used to measure the subjective pain intensity and pain unpleasantness of the participants. Study has revealed that VAS is sensitive in measuring the perception of pain of individual (Seymour, 1982). To measure the subjective pain intensity, participants were asked to indicate their perceived pain intensity by marking an “X” on a horizontal line (on the extreme right are the words “extremely painful”, and on the extreme left are the words “no pain”). To measure the subjective pain unpleasantness, participants were asked to indicate their perceived pain unpleasantness by marking an “X” on a horizontal line (on the extreme right are the words “extremely unpleasant”, and on the extreme left are the words “no unpleasantness at all”). The VAS score is determined by measuring in centimeter from the beginning of the line on the left to the “X” mark. The longer the length measured, the higher the VAS score.

The McGill Pain Questionnaire, Section 3 (MPQ)

Section 3 of the McGill Pain Questionnaire (Melzack, 1975) is a self-report rating scale that evaluates the pain that experienced by people. The scale consists of 3 items, which are used to evaluate the variation of the intensity of pain (e.g. “Which word describes your pain right now?”, “Which word describes it at its worst?” and “Which word describes your pain when it is least?”). Participants were asked to describe the intensity of pain for each of the items on a 5 point scale (mild, discomforting, distressing, horrible, excruciating).

State-Trait Anxiety Inventory, State Anxiety Subscale (STAI-Y1)

The State Anxiety Subscale of the State-Trait Anxiety Inventory (Spielberger et al., 1983) is a self-report rating scale that measure state anxiety. The subscale consists of 20 items that people usually used to describe themselves. Ten of the items were positively worded (e.g. “I feel calm) and 10 of the items were negatively worded (e.g. “I feel confused”). Participants were required to indicate how the item can apply to them at that moment through a 4-point scale ranging from 1(Not at all) to 4(Very much so). For the current sample, the State Anxiety Subscale showed an excellent reliability (Cronbach's $\alpha = 0.92$).

2.3.4 Materials

Four set of materials were distributed to the participants before the cold pressor task. Material set I was a consent form, which also included a cover story at the beginning. The aim of the cover study was to give a brief background about the study and to induce a belief in the scientific basis of the pain relief cream (all materials were presented in Chinese):

“The current study is a joint project of Stanford University School of Medicine and Lingnan University, which aim at investigating the pain perception of Asian. Stanford University School of Medicine have study human pain perception for many

years, their founding have applied to a pain relief cream, which is called Roczephin. Recently, Roczephin is planned to develop the Asian market. However, the participants of the previous study were mainly American. According to Anstine (2001), there is a different between the pain perception of Asian and American. For the same pain stimulus, Asian tends to have less perceived pain compared to American. In order to adjust the ingredient of Roczephin for Asian, Stanford University School of Medicine randomly choose 30 Asia universities to conduct a joint study about Asian pain perception, Lingnan University was one of the chosen university.”

Material set II was an article about pain and pain relief cream. It was used to manipulate the motivation of participants to use pain relief cream to reduce pain. The article consists of a high motive and low motive version. The high motive version of the article stated that feeling pain is harmful to human body and using pain relief cream is beneficial. While the low motive version of the article stated that feeling pain is beneficial to human body and using pain relief cream is harmful. Questions were located at the end of both versions of the article. The questions were the same for the two version of article. For the first part of the questions, it consisted 4 questions which aimed at checking the participants' understanding of the article. Participants were required to circle the right answer based on the corresponding article they had read. (e.g. “Feeling pain after getting hurt will (higher/lower) the chance of bacterial infection.”). For the second part of the questions, it consisted 6 items which aimed at checking the manipulation of participants' motivation to reduce pain. (e.g. “Generally speaking, using pain relief cream is beneficial”) Participants were asked to indicate their extent of agreement to the items on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). For the current sample, it showed a good internal consistency (Cronbach's $\alpha = 0.72$).

Material set III included a leaflet about the pain relief cream Roczephin and also a questionnaire about Roczephin. The leaflet aimed at inducing a high expectation of the effectiveness of Roczephin. The short questionnaire was given to participants with the leaflet, which aimed at checking the expected effectiveness of Roczephin. The questionnaire consisted 4 questions. One of the question was asking the willingness of participants to buy Roczephin, which aimed at hiding the true intention of the questionnaire and pretend to have a marketing purpose. While the other 3 questions were measuring the expected effectiveness of Roczephin. (e.g. “If I used Roczephin, I expect it can effectively reduce my physical pain.”) Participants were required to show their extent of agreement to the items on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). For the current sample, the items showed a good internal consistency (Cronbach's $\alpha = 0.86$).

Material set IV was a questionnaire that aimed at analyzing the participants' perception of pain and anxiety after they did the cold pressor task. The visual analogue scales, McGill Pain Questionnaire and State Anxiety Subscale were included in this material set. The details of the scales were mentioned in the previous section.

A sample of Roczephin was given to participants in the possession group. The cream was actually a moisturizing cream without any claimed medical effect. A small plastic bag was used to contain the sample cream. A logo and drug fact of the Roczephin were displayed at the front of the small plastic bag. Participants in the possession group were given the sample of the cream as souvenir. They were asked to sign on a form upon the reception of the cream. This aimed at strengthen their sense of possession of the cream.

During the Cold pressor task, two water tubs were used to contain water. Two thermometers were used to measure the temperature of the water and to make sure the

water temperature was consistent across participations. Ice was used to maintain the cold temperature of water.

2.3.5 Procedure

Phase I: online registration

The recruited participants were asked to register online. At the beginning of the registration, participants were required to read an informed consent form. They were asked to click a button of agreement in order to show that they have read and agree to voluntarily participate in the study.

In the second part of the registration, participants were asked to fill in their demographic information. After that, they were required to complete a questionnaire measuring their personality trait.

In the final part of the registration, participants were asked to select an available time slot to participate in the pain perception test (i.e., cold pressor task). Each time slot was available for only 3 participants. Upon completion, a confirmation email was sent to the participant.

Phase II: Pain perception test

During the appointment time slot, participants were first be given Material set I. Participants were required to read the cover story and sign on the form to show their agreement to participate in the experiment.. After that, they were asked to read Material set II which aimed at manipulating their motivation to reduce pain. Different versions of Material set II was given to participant according to their assigned conditions. Participants were asked to read the article and then answer a list of questions which were located at the end of the article. Next, Material set III was distributed to the participants. They were asked to read the leaflet to enhance their expectation about the effectiveness of the cream. After that, participants of the two possession conditions were given a sample of Roczephin. They were required to sign

on the receipt upon receiving the sample to establish their sense of ownership over the cream. Then participants from all of the condition were guided to perform a pain perception test (i.e., the cold pressor task) one by one.

The cold pressor task was used to induce acute pain to participants. Participants of the four conditions were guided to follow the same procedure of the cold pressor task. They were first asked to put their non-dominant hand into a water tub that filled with room temperature for 2 minutes in order to standardize the hand temperate of participants. Right after that, they were guided to immerse the same hand into another water tub that filled with cold water for 1 minute. They were instructed to pay attention to the induced pain during the immersion. They were allowed to withdraw their hand if they were unable to tolerate the pain. The temperature of the cold water was maintained at 5°C. A timer was used to measure their duration of time (the time between they immersed their hand into the cold water and the time they withdrew their hand from the water).

Upon completion, participants were given Material set IV. Participants were required to answer the questions to indicate their perceived pain and their state anxiety level.

3. Results

3.1 Manipulation Check

The result of manipulation check regarding motivation to reduce pain and expectation of the pain relief cream are reported as below.

On average, participants who read the high motive version of article showed a significant higher motivate to reduce pain compared with participants who read the low motive version (See Table 1). Furthermore, the difference was significant, $t(55) = 5.66, p < .001$.

Table 1.*Motivation to reduce pain in both high motive and low motive version*

Version of article	Score on motivation questions (7 point scale)		
	Number of participants	Mean	Standard deviation
High motive version	29	4.79	0.71
Low motive version	28	3.66	0.79

In general, across the four conditions, participants reported an acceptable expectation of the effectiveness of Roczephin ($M = 5.72$, $SD = 0.73$) on the 7-point scale.

3.2 Descriptive data

Descriptive data of variables among the four conditions are reported in Table 2. The variables include age, gender, scales of personality traits and scales of perception of pain.

3.3 Correlation between variables

The correlation between personality traits, state anxiety and pain perception are listed in table 3. As shown in the table, only state anxiety (STAI-Y1) is significantly correlated with the pain perception of participants, while the other personality traits (including trait anxiety, suggestibility, desire of control, dispositional optimism and fear of pain) did not showed a significant correlation with the 5 pain measurements.

Table 2.*Descriptive statistics of variables among different conditions*

Variables/Scales		Conditions			
		Possession-high motive condition (N=15)	Possession-low motive condition (N=13)	Non possession-high motive condition (N=14)	Non possession-low motive condition (N=15)
Age	M	20.93	22.00	21.57	21.00
	SD	1.91	1.95	2.53	1.25
Gender	Male	2	2	4	4
	Female	13	11	10	11
STAI-Y2	M	2.30	2.22	2.28	2.19
	SD	.96	.38	.47	.33
CLOT-R	M	3.87	4.45	4.05	4.52
	SD	.96	.64	.89	1.01
DCS	M	4.34	4.63	4.52	4.94
	SD	.57	.68	0.51	.87
SSS	M	4.07	4.22	4.30	3.85
	SD	.57	.62	.69	.71
FOPQ-III	M	3.20	3.14	2.89	2.98
	SD	.65	.62	.76	.68
STAI-Y1	M	2.30	2.12	2.01	2.37
	SD	.57	5.11	.48	.56
VAS _{intensity}	M	12.11	10.76	11.75	12.25
	SD	1.56	3.24	1.96	1.46
VAS _{unpleasant}	M	9.75	10.00	9.02	9.66
	SD	3.80	2.87	3.94	3.01
MPQ _{now}	M	1.93	2.46	2.43	2.20
	SD	.70	.97	1.09	.77
MPQ _{worst}	M	3.47	3.77	4.00	3.73
	SD	1.06	1.30	1.08	1.10
MPQ _{least}	M	1.53	1.69	1.93	1.73
	SD	.64	.75	.92	.70

Note. VAS_{intensity} is the VAS score for pain intensity, VAS_{unpleasant} is the VAS score for pain unpleasantness, MPQ_{now} is the MPQ pain score for the pain right now, MPQ_{worst} is the MPQ pain score for the pain at its worst and MPQ_{least} is the MPQ pain score when the pain is at its least. For other variables notation, please refer to the measurement section.

Table 3.*Correlation between personality traits, state anxiety and pain perception*

Scales	Pain perception measurement				
	VAS _{intensity}	VAS _{unpleasant}	MPQ _{now}	MPQ _{worst}	MPQ _{least}
STAI-Y2	0.094	0.177	0.053	-0.015	0.137
CLOT-R	0.005	0.059	0.157	0.172	0.025
DCS	-0.104	-0.154	-0.168	-0.198	-0.217
SSS	0.041	0.134	0.227	0.219	0.076
FOPQ-III	0.033	0.184	0.187	-0.041	0.034
STAI-Y1	0.234	0.300*	0.354**	0.225	0.092

Note. VAS_{intensity} is the VAS score for pain intensity, VAS_{unpleasant} is the VAS score for pain unpleasantness, MPQ_{now} is the MPQ pain score for the pain right now, MPQ_{worst} is the MPQ pain score for the pain at its worst and MPQ_{least} is the MPQ pain score when the pain is at its least. For other variables notation, please refer to the measurement section.

* $p < .05$ ** $p < .01$

Although participants were required to immerse their hand in the cold pressor task for 1 minute, some of them withdraw their hand before 1 minute. Furthermore, state anxiety also showed a significant correlation with pain perception of participants. Therefore, the duration of immersion and state anxiety variable were controlled in the following analysis.

3.4 Effect of “possession status” and “motivation to reduce pain” on pain perception

Multivariate analysis of covariance (MANCOVA) was conducted with “possession status” (possession group vs. non-possession group) and “motivation to reduce pain” (high motive vs. low motive) as independent variables, and 5 pain perception measurements as dependent variables. The dependent variables included VAS_{intensity}, VAS_{unpleasant}, MPQ_{now}, MPQ_{worst} and MPQ_{least} *. State anxiety and duration of immersion were controlled in the analysis.

The data showed a significant interaction effect of possession status and motivation, $F(1, 47) = 6.5, p = .014, \eta_p^2 = .31$. Follow up analysis showed that this

*Note. VAS_{intensity} is the VAS score for pain intensity, VAS_{unpleasant} is the VAS score for pain unpleasantness, MPQ_{now} is the MPQ pain score for the pain right now, MPQ_{worst} is the MPQ pain score for the pain at its worst and MPQ_{least} is the MPQ pain score when the pain is at its least.

significant possession status X motivation interaction effect mainly qualified on the MPQ_{now} score (measured by the question “Which word describes your pain right now?”), $F(5, 43) = 3.84, p = .006, \eta_p^2 = .31$ (see Figure 1). No significant possession X motivation effect was found for the other dependent variables.

Figure 1. The interaction effect of possession status and motivation to reduce pain on MPQ_{now} score.

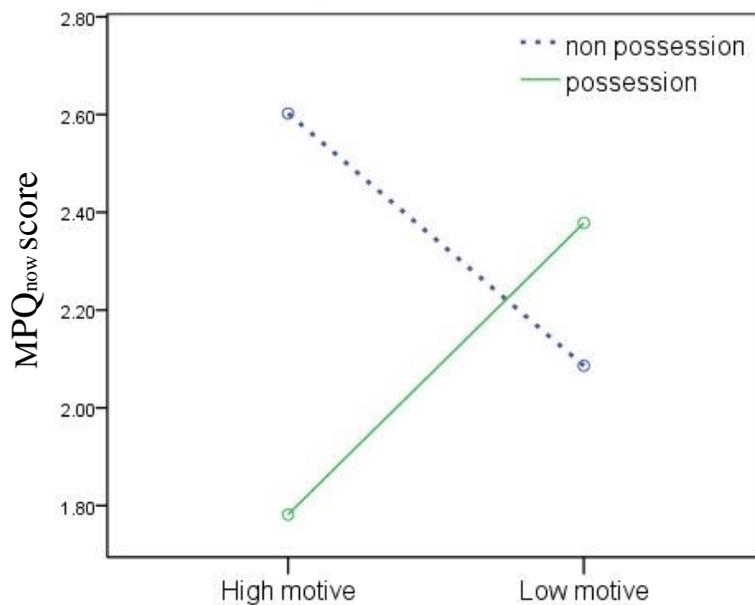


Figure 1 showed that when participants have a high motive to reduce pain, those who possessed the pain relief cream showed a significant lower pain perception, as indicated by a lower MPQ_{now} score, ($M = 1.86, SD = .66$) than participants who did not possess the pain relief cream ($M = 2.46, SD = 1.13$), $F(1,23) = 15.66, p = .001$.

However, when participants have a low motive to reduce pain, regardless of whether they possessed the pain relief cream ($M = 2.42, SD = .996$) or did not possess the pain relief cream ($M = 2.20, SD = .775$), their pain perception did not differ significantly, $F(1, 23) = .516, p = 0.480$.

4. Discussion

4.1 Demonstration of precebo illusion

One of the purposes of the present study is to demonstrate the existence of a precebo illusion in the domain of pain analgesia. For the 5 measurements of perceived pain, only one of the measurements (“Which word describes your pain right now?”) reported a significantly lower perceived pain in the possession-high motive group. It is argued that the recall of pain perception was less accurate and lead to an insignificant result.

For the 4 measurements that showed an insignificant result, they were measuring the perceived pain that participants experienced during the cold pressor task (e.g. “Which word describes your pain at its worst?”). A study has confirmed that owing to the reconstructive nature of memory, the recall of pain intensity and pain unpleasantness cannot accurately represent the actual perceived pain (Lefebvre & Keefe, 2013). Furthermore, another study of labor pain recall showed that the recall of labor pain was not accurate even though participants having an accurate recall for the context of labor pain (Niven & Brodie, 1996). However, for the measurement that showed a significant result, it was measurement the direct perceived pain of participants (measured by the question “Which word describes your pain right now?”), instead of recalling the pain memory. Since after participants withdraw from the cold pressor task, the induced physical pain was decrease gradually. Therefore, participants still experience certain kinds of physical pain when they were answering the pain analysis questionnaire. It is argued that the measurement (“Which word describes your pain right now?”) is specifically measuring the direct perceived pain that the participants were still experiencing when answering the question, which did not involve the recall of pain memory. As a result, the measurement of the direct

perceived pain which participants were still experiencing is argued to be more accurate and hence successfully shown a significant result.

The current findings suggest that when people possess a high expectation pain relief cream and have a high motivation to reduce pain, they would perceive less physical pain from pain stimulus even though they had not yet used the cream.

4.2 Investigation of underlying mechanism of precebo illusion

The second purpose of the study is to investigate the underlying motive-expectation concordance mechanism of precebo illusion. The findings suggested that a high motivation to reduce pain is necessary to trigger the precebo illusion of pain analgesia. In other words, even though people possess a pain relief cream that they are expected to be effective, they would not experience less perceived pain unless they have a high motivation to reduce pain. Therefore, motivation is confirmed to be a necessary factor of precebo illusion according to the current findings.

4.3 Implication

The current findings revealed that precebo illusion could occur in pain perception of people. The data in the current study suggested that a mere possession of an object (a pain relief cream) could make people feel to have already benefited from it (perceived having a lower physical pain) even without utilizing it. The findings have important implication in the medical field. For instance, dentist nowadays sometimes would offer painkiller to patients after certain kinds of oral treatments. However, it could be better to offer the painkiller to patients before the oral treatment although the patients are not going to use it during the treatment. As suggested by the current findings, the mere possession of painkiller could generate a precebo illusion of pain analgesia i.e., patients could illusionarily perceive having less

physical pain during the oral treatment if they have already possessed the painkiller before the treatment.

Apart from that, since precebo illusion can be surmised as a component of placebo effect. The demonstration of precebo illusion suggested that placebo effect can probably be divided into two stages. The first stage is the precebo illusion, which create a psychological effect to people by a mere possession of high expectation placebo. While the second stage is the psychological phenomenon that created after using the placebo. Therefore, future research on placebo effect can consider placebo effect as a two stages psychological phenomenon.

4.4 Limitation and future research

There were few limitation of the current study. First, owing to the small sample size of the study, the data result was less conclusive. Second, all participants of the current study were Lingnan students and most of them were females. The current findings were lack of generalizability and transferability. To further examine the effect of precebo illusion, it is suggested to address a lager sample size and also obtain a less bias sample by balancing the gender and recruiting non-students in the future study.

Thirdly, the order of participants to participate in the cold pressor task would affect the result. Due to the limitation of resource, there were 3 participants participated the experiment in each time slot. After reading the article and leaflet, participants were required to participate the cold pressor task one by one. Although participants were instructed not to communicate with other participants, the facial expression of participants that already finished the cold pressor task may affect the other participants' expectation of the induced pain. After interviewed some of the participants after the study, some of the participants reported that they felt more anxious after observing the facial expression of participants who finished the cold

pressor task. In future study, it is recommended that only involve one participant in every time slot of the experiment.

Finally, to further examine the underlying motive-expectation concordance mechanism in the future, it is suggested to investigate whether a high expectation of cream is necessary in triggering placebo illusion of pain analgesia. The current findings suggested that when people possess a high expectation pain relief cream and have a high motivation to reduce pain, possessors would perceive less physical pain. However, the current study did not examine whether a high expectation of cream is necessary in triggering placebo illusion. In future study, it is suggested to also manipulate participants' expectation of pain relief cream (high expectation vs. low expectation), in order to further examine the underlying mechanism in the future.

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