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Interpersonal behavior in anticipation of pain: a naturalistic study of behavioral mimicry prior to surgery

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Abstract

Introduction: Social relationships facilitate coping with pain, but research suggests that it may be difficult to galvanize social support *during* an episode of acute pain.

Objectives: The current research examined whether social connections are optimized in the *anticipation* of pain by observing patients' mimicry of an interaction partner prior to surgery. We hypothesized that when controlling for their current experience of pain, patients' anticipation of pain would be associated with greater mimicry of an interaction partner.

Methods: Sixty-five patients were interviewed in the waiting room of a maxillofacial surgery unit prior to the removal of an impacted wisdom tooth. Patients' spontaneous mimicry of an interviewer was observed. Patients then rated the quality and intensity of their anticipated pain, as well as the intensity of their current pain and their affective distress.

Results: Anticipated pain, current pain, and affective distress were positively correlated. Current pain was associated with less frequent mimicry of an interaction partner. The zero-order correlation between anticipated pain and mimicry did not reach conventional levels of significance; however, when controlling for current pain, anticipated pain predicted more frequent mimicry of an interaction partner. The relationship between anticipated pain and mimicry was not explained by affective distress.

Conclusion: This is the first study to demonstrate that anticipated and current pain relate to behavioral mimicry in divergent ways. Further research is needed to investigate whether the current pattern of results generalizes to other interpersonal behaviors that facilitate social bonds.

Keywords: Anticipated pain, Perioperative pain, Affiliation, Interpersonal behavior

1. Introduction

People are generally better able to cope with pain and recover from injury when supported by others [for a review, Ref. 31]. To a certain extent, support from others is elicited by the expression of pain behaviors, which trigger empathic concern and motivate caregiving behavior.[57] However, an empathic response to another's pain largely depends on the strength of one's social connection to that person.[9,10,44] A number of research findings suggest that interpersonal behaviors that build social connections with others may be impeded during the experience of pain, since it focuses attention on self-protection and emotion regulation,[20,30] and challenges one's ability to devote attention and care to others.[20,55,57] Reflecting this, experimental pain has been shown to increase aggression and egocentricity[7,38] and reduce perspective taking and cooperation.[42] In view of these potential obstacles to forming social bonds *during* the experience of pain (when social support is most needed), the current research investigates whether people seek to connect with others prior to the experience of pain, that is, *in anticipation* of pain.

Converging research findings suggest that in anticipation of an impending need for social support, people spontaneously display interpersonal behaviors that develop or fortify social bonds.[6] For example, the anticipation of future loneliness and social exclusion (being ignored) elicits more mimicry of others,[34] more positive evaluations of others, more cooperative behavior, and more interest in making new friends.[39,41] While this research indicates that people engage in more relationship-building behavior in anticipation of what has been termed "social pain" (ie, exclusion or hardship),[19,36] there has been no research to date that

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examines interpersonal behavior in anticipation of acute nociceptive pain. The current research takes the first step toward addressing this gap in our understanding of interpersonal behavior in anticipation of pain by observing patients' mimicry of an interaction partner prior to a potentially painful event.

Mimicry is a nonverbal behavior that plays an important role in the formation and maintenance of social bonds.[35] Provided that it is subtle and socially appropriate, mimicry elicits liking, trust, and empathy from one's interaction partner, and it promotes helping and cooperation.[5,32,49] While mimicry is a largely enacted without intention or awareness,[12] it is facilitated by attention to others and a desire to form, consolidate, or repair social connections.[13,33,34] In view of the difficulties associated with making social connections during the experience of pain, we predicted that current pain would be associated with less mimicry of an interaction partner. However, in view of the value of social support for coping with pain, we predicted that when controlling for current pain, the anticipation of pain would be associated with greater mimicry of an interaction partner. To test this hypothesis, we examined patients' mimicry of an interaction partner immediately prior to a potentially painful wisdom tooth extraction.

2. Methods

2.1. Design

A cross-sectional research design was used to examine the relationship between self-reported anticipated pain and observed behavioral mimicry. The study was conducted in 2012 within the oral maxillofacial surgery unit of a university (research) hospital in the Netherlands. The participants selected for inclusion in the present study were referred to the hospital for a complex third molar extraction (the removal or an impacted wisdom tooth). Despite the use of local anesthetic during these procedures, patients often *anticipate* experiencing pain during their treatment.[56] Indeed, dental anxiety, a fear of experiencing pain or harm during oral procedures, is reported by approximately 44% of the Dutch population.[50] Hence, it was expected that patients in the current sample would be anticipating a certain degree of pain, as well as distress, prior to their surgery.

We expected a small proportion of the sample to be experiencing a certain degree of pain prior to surgery, based on data indicating that approximately 12% of impacted wisdom teeth require removal due to the onset of inflammatory disease, which is associated with pain and swelling.[24] As such, while we expected most participants to be experiencing little to no pain prior to surgery, measures of current pain were included in the study and were statistically controlled in analyses.

2.2. Participants

Seventy-two patients were recruited from the hospital waiting room prior to surgery to participate in this study. Of these, 7 did not complete the questionnaire. Hence, our final sample included 65 participants (32 female and 32 male patients; 1 gender unreported; mean age = 27 years; SD = 8.19; age range = 18–61 years). All participants were scheduled for a third molar extraction (the surgical removal of a wisdom tooth). This sample size provides us with 70% power to detect effects of $r = 0.30$ (by convention, a "medium" effect size) and 99% power to detect effects of $r = 0.50$ (by convention, a "large" effect size).[16] All wisdom tooth removals were completed under a local anesthetic. Hence, it was not expected that this sample would be experiencing hunger or thirst as is often the case prior to surgery requiring general anesthetic.

2.3. Procedure

Hospital staff provided third molar extraction patients with research information and consent forms on arrival. In the waiting room prior to their surgery, all patients who were seen to be in possession of these forms were asked to participate in the 5-minute research study while they waited for their surgery. All patients who were approached agreed to participate in the study.

The study was conducted in a private room adjacent to the waiting room, which was free from surgical equipment. Participants were interviewed by a research assistant and then completed a brief questionnaire. The interview was orchestrated to measure patients' mimicry, and the questionnaire was designed to measure patients' anticipated pain, current pain, affective distress, and demographic characteristics (age, gender).

All patient interviews were conducted in the presence of 2 (female) research assistants: an interviewer and an independent observer. The interviewer and observer were blind to the research hypotheses and trained to maintain a neutral interpersonal affect in interaction with all participants.

2.4. Ethical considerations

Ethical approval to conduct the study was obtained from the VU Amsterdam Human Ethics Committee of the Department of Experimental and Applied Psychology after amending the study design to exclude video footage of patient interviews. The presence of an independent observer in the interview was put in place to minimize error in the in vivo measurement of mimicry.

2.5. Measures

2.5.1. Mimicry

Using a method described by Ashton-James and Levordashka,[4] mimicry was observed and recorded by 2 research assistants—one functioning as an interviewer and the other as an observer. The interviewer posed 5 innocuous questions unrelated to pain, fear, or surgery (eg, "What are 2 of your favorite things to do on the weekend? Where is the next place you want to go on vacation and why? In what profession would you like to be working and why?"). As each question was posed, the interviewer enacted a scripted "target" behavior as naturally as possible: a nose rub, an ear scratch, a hair scratch, a brow stroke, a mouth touch, a posture shift, or a face touch. The interviewer and observer then independently recorded whether they observed the participant mimic the scripted behaviors. "Mimicry" was defined as the participant's (re)-enactment of the interviewer's target behavior during the course of their response to the interviewer's question. For example, mimicry was coded as being observed if a participant was observed touching, scratching, or wiping her nose after the interviewer's scripted nose touch. Hence, consistent with previous operationalizations of mimicry,[4,48] the imitated behavior need not occur at precisely the same moment (ie, in synchrony) or in precisely the same way (ie, behavior matching or mirroring).

Since mimicry was measured in vivo (rather than being video recorded and retrospectively coded), we expected the observation of mimicry to be somewhat underestimated by observers—going unobserved when present, as opposed to being observed when not present. Consequently, it was decided that participants' individual mimicry scores would be calculated as the sum of behaviors that were observed by at least 1 of the 2 research assistants who were monitoring for mimicry (notably, the total

mimicry scores for observers strongly correlated with total mimicry scores for interviewers, $r = 0.53$).

Before computing a total mimicry score for each participant, we examined the item-total correlations for each of the recorded behaviors. This analysis was conducted to identify whether behaviors were mimicked in the same way. Results revealed that 1 of the 7 target behaviors—the hair scratch–had a negative, near zero item-total correlation (−0.11), which suggests that head scratching may have been predicted by extraneous variables unrelated to mimicry. Item total correlations for the remaining 6 target behaviors ranged between 0.16 and 0.44. Excluding "hair scratch," the internal consistency of the composite mimicry score was reasonable (Cronbach $\alpha = 0.54$) in consideration of the brevity of the test (longer measures typically achieve higher reliability estimates) and the natural heterogeneity of spontaneous behavioral responses.[17,27]

2.5.2. Current pain

Participants used an 11-point scale (0 = none at all, 1–3 = mild pain, 4–6 = moderate pain, 7–10 = extreme or unbearable pain) to indicate the severity of their pain (1) at the current moment and (2) over the past 10 minutes. Given that these 2 items were strongly related ($r = 0.92$), they were collapsed into a single assessment of current pain.

2.5.3. Anticipated pain

Participants used the same 11-point scale to indicate how much pain they expected to feel during the wisdom tooth extraction. They also qualified their anticipated pain experience by rating the extent to which they expected to feel 12 pain descriptors adapted from the Brief Pain Inventory-Long Form[15] during their surgery (ie, aching, stabbing, sharp, numb, throbbing, shooting, miserable, penetrating, unbearable, exhausting, nagging). One item (anticipated numbness) had a low item-total correlation ($r = 0.11$), and it was removed from the measure. The resulting 12-item measure had stronger item-total correlations ($M_{item\text{-}total\ r} = 0.73$; $\alpha = 0.94$).

2.5.4. Affective distress

Participants used an 11-point scale (0 = not at all, 1–3 = mildly, 4–6 = moderately, 7–10 = extremely) to indicate the extent to which they felt a variety of affective states associated with stress or threat (threatened, negative, angry, frustrated, hostile, fearful, sad, helpless, and anxious; $\alpha = 0.83$, M = 1.49, SD = 1.46).

2.5.5. Data analytic technique

We used a multiple regression analysis to test our key hypothesis—that when controlling for current pain, greater anticipated pain would be uniquely associated with more frequent mimicry. Participant sex did not statistically correlate with anticipated pain or current pain and was only marginally related to mimicry (**Table 1**), and it was not therefore included in regression analyses as a covariate. Finally, we used bivariate correlations to examine the relationship between anticipated pain, experienced pain, and affective distress and a multiple regression analysis to examine whether mimicry was predicted by anticipated pain when accounting for the role of affective distress.

3. Results

3.1. Descriptive statistics

As described in **Table 1**, the mean observed mimicry score was 0.22 (SD = 0.22), indicating that, on average, participants mimicked 22% of the scripted behaviors exhibited by the interviewer. This is comparable to mean levels of mimicry reported elsewhere in the literature.[4] On average, participants reported very low levels of pain and affective distress prior to surgery (M = 0.98; SD = 1.97 and M = 1.49; SD = 1.46, respectively). By contrast, participants reported *anticipating* mild-to-moderate levels of pain (M = 3.65; SD = 2.19).

3.2. Predicting mimicry from anticipated and current pain

As shown in **Table 1**, at a bivariate level, anticipated pain was positively related to current pain, but anticipated pain and current pain shared opposite relationships with mimicry (although at the bivariate level, the relationship with anticipated pain and mimicry failed to reach conventional levels of significance). When we regressed mimicry on anticipated and current pain simultaneously, current and anticipated pain had statistically significant, opposite relations with mimicry. As predicted, when controlling for individual variation in current pain, higher levels of anticipated pain predicted more frequent mimicry ($\beta = 0.26$; $P = 0.04$). By contrast, when controlling for levels of anticipated pain, higher reported current pain was predictive of less mimicry ($\beta = -0.41$; $P = 0.003$).

3.3. Role of affective distress

As shown in **Table 1**, affective distress positively correlated with both anticipated pain and current pain. A multiple regression analysis revealed that both anticipated pain ($\beta = 0.56$; $P < 0.001$)

Table 1

Correlations and descriptive statistics.

	Mean	1	2	3	4	5	6	7
1. Mimicry	0.22 (0.22)							
2. Current pain	0.98 (1.97)	−0.38*						
3. Anticipated pain	3.65 (2.19)	0.13	0.34*					
4. Negative affect	1.49 (1.48)	0.10	0.41*	0.63*				
5. Positive affect	4.09 (2.22)	−0.19	0.13	−0.06	−0.18			
6. Liking	6.46 (1.33)	−0.04	0.31*	0.21	0.02	0.26*		
7. Participant sex	0.50 (0.50)	0.25†	−0.15	0.21	0.38*	−0.37*	−0.23	

Sample size is 65 for all correlations except for those involving participant sex, since 1 participant failed to report his or her sex. Standard deviations appear in brackets beside the means.

* Correlation is significant at the $P < 0.05$ level.

† $P = 0.05$.

and current pain ($\beta = 0.21$; $P = 0.04$) contributed uniquely to affective distress. However, affective distress was not related to mimicry at the bivariate level ($r = 0.10$; $P > 0.14$), nor was it related to mimicry when controlling for current and anticipated pain ($\beta = 0.14$; $P = 0.35$). Hence, distress did not mediate or explain the relationship between anticipated or current pain and mimicry.

4. Discussion

Previous research has demonstrated that mimicry of others facilitates liking and rapport, elicits empathic concern, and increases cooperation and helping between social partners.[37,49,53] When people are mimicked, they are more likely to have empathic concern for and come to the aid of the person by whom they are mimicked.[5,11,53] Making social connections with others is adaptive in many respects, not least because empathic concern and social bonds increase the likelihood that one will receive social support when experiencing pain.[14,21,25] In view of the benefit of social bonds for coping with pain, and the utility of mimicry for forming and consolidating social bonds, the current study examined the hypothesis that when holding current levels of pain constant, patients would mimic others more closely in anticipation of a painful event. We tested this hypothesis by measuring patient's spontaneous mimicry of an interaction partner prior to a wisdom tooth extraction. The results of our analyses provide support for this hypothesis: higher ratings of anticipated pain were associated with greater mimicry of an interaction partner when controlling for levels of current pain, which by contrast was associated with less mimicry. Additional analyses revealed that affective distress did not explain the relationship between current pain or anticipated pain and mimicry.

In the absence of an experimental control group, our results do not indicate whether the observed relationship between anticipated pain (or current pain) and mimicry is causal. However, our findings are consistent with a 1990's experiment in which participants faced with the threat of (bogus) task described as "very painful" showed more behavioral mimicry of their interaction partners than those who faced the same task described as not being painful.[26] In contrast to the present research, the aim of this earlier research was to test of the impact of stress (induced by the anticipation of a painful event) on interpersonal behavior, and consequently, anticipated pain was not measured. Interestingly, consistent with the present findings, while the threat of a painful event (vs a painless event) was associated with greater mimicry of an interaction partner, the reported levels of stress of the participants was not related to their mimicry behavior [Ref. 46]. Compounding evidence therefore supports the notion that people show greater mimicry in anticipation of a painful event, independent of the stress induced by the threatening event.

4.1. Strengths and limitations

Despite fundamentally influencing the formation and maintenance of social relationships, mimicry has rarely been studied in the context of illness or disease [Ref. 54], and never has it been studied in the context of pain. Research into the impact of pain on social relationships and behavior typically use self-report measures, which may be prone to memory bias when retrospectively reported and tend to reflect interpersonal intentions rather than actual behavior when prospectively reported.[1] By contrast, mimicry is an interpersonal behavior that occurs without awareness or intention[13] and hence may be a better predictor of relationship outcomes than self-reports.[33] Mimicry has been shown to predict a wide variety of interpersonal outcomes (Refs. 28,43,53) and hence may be a valuable addition to research examining the interpersonal consequences of pain.

While studies of mimicry typically measure a single behavior (eg, the amount of face touching that is mimicked[33]), the current study measured the extent to which participants mimicked a variety of behaviors, as would naturally occur in social interaction. This approach has advantages over single-item observations (eg, greater construct coverage). However, the modest reliability (alpha = 0.54) highlights the potential benefits of even more mimicry observations in future studies. Using the Spearman–Brown prediction formula, we estimate that future studies could aim to observe 12 mimicry behaviors to achieve an alpha of 0.70 or 20 mimicry behaviors to achieve an alpha of 0.80. However, loss in validity when reliability is 0.54 relative to 0.70 is modest,[18] and effect sizes reported here were likely not severely attenuated by unreliability.

In experimental (laboratory) settings, participants' mimicry of an interaction partner is typically captured on video (Ref. 33), which offers coders the potential to check the accuracy of their observations. In contrast, the present study of mimicry was conducted in a naturalistic setting (in a hospital waiting room), with patients (rather than students) awaiting a potentially stressful procedure. In this context, the potential benefits of video recording participant behavior needed to be weighed against the potential costs of doing so, including selective sampling of patients with low levels of preoperative anxiety and the exacerbation of patients' preoperative anxiety by video monitoring of their interactions.

The levels of affective distress, current pain, and anticipated pain reported by participants in the current study were relatively low (mild–moderate). This may reflect a lack of sensitivity in our measures, the influence of social desirability bias, or indeed a context effect on pain reporting. Patients were awaiting a relatively simple surgical procedure in a hospital (rather than a dental clinic), and perhaps by comparison with other patients in the hospital waiting room, they felt that their pain, and the pain associated with their procedure, was minimal. While it is possible that the results of the present study may not be generalizable to patient populations who report experiencing or anticipating more severe levels of pain, we expect that more intense pain would be associated with even greater attention to self-protection concerns and that more intense anticipated pain would be associated with greater motivation to form social attachments in preparation for coping with pain, and this requires empirical investigation.

4.2. Future research directions

In addition to testing the robustness of the relationships we have observed between pain, anticipated pain, and mimicry in contexts associated with greater anticipated pain, our proposition that relationships are optimized in anticipation of pain could be further tested with other interpersonal behaviors that contribute to the formation and maintenance of social connections. For example, controlling for the experience of current pain, we expect that people would show more attention to others (as indicated by eye gaze direction), more prosocial behavior (helping, generosity, cooperation), and greater empathy and perspective taking. By contrast, we expect that people's current pain levels will be inversely related to their attention to and motivation to help others.

We have theorized that it may be adaptive for people to mimic social partners in anticipation of a painful event, at which time they may not have the attentional resources to form or reinforce social bonds. It is notable, however, that the social relationships of people with chronic pain do not appear to be adequately fortified by their

(frequent) anticipation of pain. It is common for individuals with chronic pain to experience predictable flare-ups of pain in response to changes in activity levels, mood, and environment.[3,8,22] However, the experience of chronic, inescapable pain can lead to social resignation, helplessness,[23,52] and social reticence.[2,51] Hence, it is possible that when individuals have chronic pain, they do *not* show greater mimicry (or other relationship-building interpersonal behavior) in anticipation of a pain flare-up. Research investigating the relationship between anticipated pain and interpersonal behavior in the context of chronic pain is needed to test this hypothesis. This line of research would provide much needed insight into the interpersonal processes that contribute to social isolation and relationship deterioration that is commonly observed in people with chronic pain.

Finally, future research into mimicry and other interpersonal behaviors in the context of anticipated or current pain should consider possible moderators such as the relationship status of the interaction partners,[29,40] the perceived trustworthiness of one's social partner,[47] the attachment styles of the person experiencing or anticipating pain,[45] and the availability of alternative strategies for coping with pain.

5. Conclusion

When controlling for current pain, greater anticipated pain is associated with greater mimicry of an interaction partner prior to surgery. These results are consistent with the notion that interpersonal behaviors in the service of forming social bonds may be promoted by the anticipation of pain and a need for social support. Further research is needed to test the robustness of these findings, preferably with experimental controls to establish causality. In consideration of the contribution of social relationships to the modulation of pain, the current study represents an important first step toward understanding the interpersonal behavior of individuals who are currently anticipating or experiencing pain.

Disclosures

The authors have no conflicts of interest to declare.

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