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Empathy Predicts an Experimental Pain Reduction During Touch

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Abstract: **Previous studies have provided evidence for pain-alleviating effects of segmental tactile stimulation, yet the effect of social touch and its underlying mechanism is still unexplored. Considering that the soma affects the way we think, feel, and interact with others, it has been proposed that touch may communicate emotions, including empathy, interacting with the identity of the toucher. Thus, the goal of the current study was to examine the analgesic effects of social touch, and to test the moderating role of the toucher's empathy in analgesia using an ecological paradigm. Tonic heat stimuli were administered to women. Concurrently, their partners either watched or touched their hands, a stranger touched their hands, or no one interacted with them. The results revealed diminished levels of pain during partners' touch compared with all other control conditions. Furthermore, taking into account the dyadic interaction, only during the touch condition we found 1) a significant relationship between the partners' pain ratings, and 2) a significant negative relationship between the male touchers' empathy and the pain experience of their female partners. The findings highlight the powerful analgesic effect of social touch and suggest that empathy between romantic partners may explain the pain-alleviating effects of social touch.**

Perspective: ***Pain research mostly concentrates on different factors around a single pain target, without taking into account various social interactions with the observers. Our findings support the idea that pain perception models should be extended, taking into account some psychological characteristics of observers. Our conclusions are on the basis of advanced statistical methods.***

Key words: *Empathy for pain, touch, romantic couples, experimental pain, analgesia.*

Skin-to-skin touch is a special form of tactile sensation that has an important and major role in social communication and affiliation.[26] Social touch has been shown to affect our emotional well-being and diminish distress or pain in various settings.[10,19,21,26,31,37,74,80] The neurological mechanism that underlies social touch analgesia is not totally clear.[4,5] Earlier experimental studies showed that application of segmental tactile stimulation can gate nociceptive input at the spinal cord.[3,68,69] However, recent studies have shown that supraspinal mechanisms also have a significant role in the analgesic effect of tactile stimulation.[37,54,60] For example, Mancini et al[54] showed that the laser blink reflex and pain-evoked potentials are suppressed by tactile stimuli, indicating that tactile stimulation-induced analgesia in homotopic areas is mediated by subcortical and cortical areas.

The powerful analgesic effect of tactile stimulation is not solely mediated by its inhibitory effect on the nociceptive information arriving at the spinal and supraspinal levels, because tactile stimulation (ie, touch), given in a remote area also reduces pain.[8,54] Moreover, it has been shown that the effects of touch are not uniform and are dependent on the identity of the toucher; holding a partner's but not a stranger's hand reduces anxiety and blood pressure reactivity to stress, together with attenuation of brain neural activity supporting emotional and behavioral threat responses.[10,32,46] Possibly other factors related to the toucher may interact with the effects of the touch including her/his empathic abilities.[46] Empathy enables us to understand

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what it feels like when someone else experiences sadness, happiness, pain, or touch.[11,27] It has been suggested that empathy has a key role in social touch,[5] and individual differences in empathy may affect whether people react prosocially.[52,59] A specific and important subtype of empathy mechanisms is that of empathy to pain, a concept that describes our tendency to automatically experience distress when facing someone else's pain.[20,44,72,73]

It was reported that empathy to pain modulates the target's pain perception,[38,70] causes an aversive arousal course of action, and an activation of affective/emotional brain regions.[45] Furthermore, it has been recently suggested that the level of the perceiver's empathy predicts the degree of his/her primary somatosensory cortex (SI) activation when seeing a hand being touched by nonpainful and painful stimuli.[3,10,70] This suggests that our empathic abilities may not only shape the way we perceive the distress of a target but also the way we react to it. Recently, there is growing recognition of the significance of a communication role in pain.[34] For example, the biopsychosocial model tries to explain a physical illness such as pain by a dynamic interaction between physiologic, psychological, and social factors.[29] According to the biosocial model,[13] communicating social understanding and responding empathically to a person in pain[6] may reduce negative affect.[13] Thus, someone who receives validation feedback after sharing their pain-related thoughts and feelings, will feel understood and accepted. This enables the sufferer to experience their partner's empathy, which may subsequently reduce their pain experience.[65,66] According to this theoretical framework, social touch may enhance the empathic sharing between the suffering person and their surrounding support. Thus, couples who experience more empathy to each other, compared with strangers, may provide a more attuned and rewarding touch that may in turn increase the analgesic effect of touch.

The current study aimed to examine the relationship between the empathic abilities of the toucher and the pain-alleviating effects of touch. We hypothesized that: 1) social touch will diminish levels of experimental pain compared with no touch, 2) a life partner's touch will have a stronger analgesic effect compared with that of a stranger, and 3) the toucher's empathy level will predict the touch-induced analgesia effect of his/her partner.

Methods

Study 1

Participants

Participants were 23 heterosexual couples between 19 and 40 years without children. The couples were screened in a telephone interview and were informed that they would participate in a pain perception study. Exclusion criteria included: 1) acute or chronic pain, 2) medication use (except for oral contraceptives), 3) a history of neurological disorders, psychiatric problems, or metabolic problems; 4) pregnancy, and 5) left-handedness.

Questionnaires

Interpersonal Reactivity Index. A 28-item questionnaire measuring empathic capacity in 4 separate subscales: 1) perspective taking, 2) empathic concern, 3) personal distress, and 4) fantasy, all with reliability in the range of .70 to .89.[11] The Hebrew version of the Interpersonal Reactivity Index (IRI) was validated by A. Even (unpublished, doctoral dissertation, 1993).

Short ENRICH scale. The short Evaluation and Nurturing Relationship Issues, Communication, and Happiness (ENRICH) scale is a 10-item Likert type scale assessing the respondent's perceived quality of his or her romantic relationship. The questionnaire was adopted for the Hebrew-speaking population and has been reported to have good reliability on estimates of scale, as well as high concurrent and predictive validity.[23,47]

Awareness scale. To investigate the awareness of the female participants to the possible effects of romantic touch, their rating of their partner's or a stranger's touch or presence in helpfulness in reducing their pain were obtained at the end of the experiment. The scale ranged from 0, denoting "not helpful," to 100, denoting "very helpful."

Psychophysical Tests

All contact heat stimuli in this experiment were applied to the left volar forearm, using a 3-cm^2 computer-controlled Peltier-type thermode (TSA-2001, Medoc, Ramat-Yishai, Israel). During the procedure of pain familiarization, the participants were exposed to 3 short contact-heat stimuli (43°C, 45°C, and 47°C), each for 7 seconds, given in a semirandomized order with an interstimulus interval of 10 seconds. Subjects were asked to report pain intensity using a numerical pain score (NPS), ranging from 0, denoting 'no pain', to 100, denoting 'the worst pain imaginable,' writing the number on a small piece of paper, invisible from others present.

Stimulus intensities were adjusted to each female subject to evoke a peak pain magnitude of 60 of 100 (pain-60) on the NPS using the algorithm described by Granot and colleagues.[30] According to the algorithm, subjects were exposed to a 7-second series of stimuli. The first series consisted of 45°C, 46°C, and 47°C stimulations. After each stimulus, subjects were asked to report the level of pain. If one of these stimuli induced pain intensity of 60 on a 0 to 100 NPS, that temperature was chosen as the test stimuli for the rest of the experiment; if not, additional series of stimuli were applied below (43°C and 44°C) or above (48°C and 49°C) the previously mentioned temperatures, for the determination of pain-60. To validate the pain-60, an additional stimulus at the same intensity was given at the end of the process and scored. To further verify the pain-60 and the absence of a 'carryover' effect between successive pain conditions, subjects were asked to report pain intensity 5 seconds after the pain stimulus initiation during each experimental condition.