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Is compassion a part of the non-specific effects of acupuncture?

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ABSTRACT

Acupuncture is widely used for the treatment of chronic (long-term) pain. In a recent study, Vickers et al. characterized the analgesic effect of acupuncture in four different chronic pain conditions, back and neck pain, osteoarthritis, headache, and shoulder pain, and concluded that acupuncture is an effective type of treatment for these chronic pain states.

Significant differences between true and sham acupuncture indicate that acupuncture induces superior effects. However, these differences were reported to be relatively modest, suggesting that non-specific effects, in addition to the specific effects of the needle stimulation, are important contributors to the therapeutic effects of acupuncture. It has been demonstrated that two factors that are seen as non-specific are related to individual therapists' interaction with the patient and the patients' positive expectation of the treatment effect.

The therapist–patient interaction has been shown to be unrelated to empathy but may be attributable to the ability to express compassion. Compassion implies being attuned to undeserved suffering, but it is also a signaling behavior related to care giving that has physiological responses that orient the individual to social interaction. It is possible that therapists that report good treatment outcomes are more compassionate in their interaction with their patient compared to the therapist reporting poor outcomes.

1. Acupuncture and non-specific effects

Acupuncture is a complex intervention that achieves its outcome through a combination of specific and non-specific mechanisms, including the patient–therapist relationship, the individual therapists' compassion, the patient's expectation of positive treatment results, suggestibility, conditioning to the treatment situation, treatment rituals, and the therapist biasconcerning the treatment [1,2]. In a recent study, Vickers et al. characterized the analgesic effect of acupuncture in four different chronic pain conditions: back and neck pain, osteoarthritis, headache, and shoulder pain [3]. They concluded that acupuncture is an effective treatment in these chronic pain states. In addition, they reported significant differences between true and sham acupuncture, suggesting that acupuncture is more effective than a sham procedure. However, these differences were relatively modest, suggesting that additional factors other than the specific effects of the needle stimulation (i.e., the non-specific effects) were important contributors to the total therapeutic effects of acupuncture.

To elucidate the influence of contextual factors, White et al. investigated possible enhanced non-specific effects associated with needle stimulation in acupuncture treatment [2]. The non-specific effects of acupuncture were assessed in 221 osteoarthritis (OA) pain patients using a multitude of interventions (manual acupuncture stimulation, the use of Streitberger "placebo" acupuncture needles, mock transcutaneous electrical nerve stimulation) each with empathic or non-empathic consultations. The patients rated lower pain intensity after all interventions compared with baseline. Empathic consultations did not affect pain. One therapist had significantly better outcome. The patients perceived the "best" therapist to be a paternalistic male authority figure and the authors suggested that this possibly may be because he was seen as the expert, consequently establishing higher expectations of success. In another study though, assessing the effects of acupuncture in hot flashes, the "best" therapist was found to be a female who was reported by the patients as demonstrated more compassion. Interestingly, four independent assessors of the trial, who had met with the trial therapists, had all predicted that she was going to be the therapist with the best outcomes. Taken together, these results would suggest that an undefined characteristic of the treating therapist can be used to predict the outcome as well as the patients' expectations. Interestingly, these two factors were shown to be independent of each other in the study by White et al. [12].

The obvious question is "What characterizes the best (or a very good) acupuncture or related technique therapist?" Is it possible

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that a therapist with a better-reported outcome is more compassionate (resulting in a better attachment between the therapist and the patient) compared with a therapist where patients report poorer outcomes?

2. Compassion – definition and evolution

Compassion is defined as a feeling of deep sympathy and sorrow for another who is stricken by misfortune, accompanied by a strong desire to alleviate the suffering. Compassion is regarded as a fundamental part of human love, social interconnection and humanism, but it is also considered foundational to the highest laws in philosophy, society, and personhood. In a clinical context, compassion may be defined as the feeling that arises in witnessing another's suffering and that motivates a subsequent desire to help [4–6]. This definition conceptualizes compassion as an affective state defined by a specific subjective feeling and differentiates compassion from sympathy, pity and empathy, out of which the latter refers to the vicarious experience of another's emotions [7,8]. In addition, it has been argued that the term compassion is better because it encompasses a broader set of states, i.e., states that center upon a concern for ameliorating the suffering of another individual [9–11]. It may be argued that compassion emerged as a distinct affective state and trait because it enhances the welfare of vulnerable offspring, because it is a desirable emotion or attribute in mate selection processes, and because it enables cooperative relations with non-kin [12–17]. Within the context of this vulnerable offspring argument, compassion is thought to have emerged as the affective element of a care giving system designed to help raise vulnerable offspring to the age of viability and thus ensuring that genes are replicated Warneken and Tomasello [18,19].

3. Elicitation of compassion: the interoceptive system – influence of touch – "placebo acupuncture" – vocational communication

3.1. The interoceptive system

It has been reported that primates have a distinct cortical image of homeostatic afferent activity that reflects all aspects of the physiological condition of the body [20]. This interoceptive system, associated with autonomic motor control, is distinct from the exteroceptive system that guides somatic motor activity. The primary interoceptive representation in the dorsal posterior insula produces distinct feelings from the body that include pain, temperature, itch, touch, muscular and visceral sensations, vasomotor activity, hunger, thirst, and other such sensations. In humans, a representation of the primary interoceptive activity is created in the right anterior insula, which provides the basis for the subjective image of the material self as a feeling (sentient) entity, that is, emotional awareness [21,22]. Likely, endogenous homeostatic control mechanisms (including parasympathetic and sympathetic) modulate the integration of afferent and efferent activity that produces emotional awareness [23,24]. Such integration of all feelings from the body points to the dependence of subjective well-being on the physiological health of the body [72]. The emerging evidence from imaging studies that volitional cortical control in humans can directly modify homeostatic integration and the substrate of the feeling of self signifies the fundamental role of this interoceptive system in human consciousness [25,26].

3.2. Touch

Non-verbal expressions of emotion serve several functions [27,28]. Emotional displays in the face, voice, and body signal specific intentions. It has been demonstrated that touch is the primary form of interaction for the development of secure attachments and cooperative relationships. Olausson et al. have reported that there are two sensory systems with possible roles in secure attachments. One of these systems is set up by mechanosensitive C-fiber tactile (CT) afferents sensitive to slowly moving stimuli on hairy skin that project to the posterior insular cortex and signal pleasant aspects of touch. However, CT-fibres have not been found in the glabrous skin of the hand despite the fact that glabrous skin touch is also perceived as pleasant. Therefore, Olausson et al. recently set out to elucidate if the brain processing of pleasant touch differs between hairy and glabrous skin by stroking the forearm and glabrous skin of the hand. When comparing slow brush stroking on the forearm with slow brush stroking on the palm, there were significant activations of the posterior insular cortex and mid-anterior orbitofrontal cortex. In contrast, the palm touch resulted in a significant activation of the somatosensory cortices. These results are in line with the reports of psychophysical rating using a newly developed "touch perception task." Emotional descriptors received higher ratings on the forearm and sensory descriptors were rated more highly on the palm. Olausson et al. recent findings are consistent with their hypothesis that pleasant touch of hairy skin, mediated by CT afferents, is processed in the limbic-related cortex and represents an innate non-learned process. In contrast, pleasant touch from glabrous skin, mediated by A-beta afferents, is processed in the somatosensory cortex and represents an analytical process dependent on previous tactile experiences [29]. It has also been reported that light touch induces activation of the reward system in the brain [30], whereas hard pressure may result in stress [31,32].

3.3. Placebo acupuncture

Touch also promotes cooperation and reciprocal altruism. In humans, friendly patterns of touch have been found to increase compliance to requests [33] and cooperation with strangers in economic games [34]. This would suggest that touch is involved in two social processes related to compassion: soothing and the formation of cooperative bonds. If so, tactile contact using different types of "placebo" acupuncture or verum acupuncture is a modality in which compassion is communicated [35–37]. For example, participants in a study were asked to communicate 12 different emotions to another participant via touch on the forearm, including sympathy, fear, sadness, and love. In general, the recipients of the touch could discern that sympathy was being communicated. Interestingly, patting and stroking were also associated with, but considered separate from, love and gratitude. In another study, videotapes of brief hand-to-forearm touches were interpreted as being associated with sympathy by the observers of the videotape [35]. This is in contrast to the low recognition accuracy of compassion, fear, sadness, and happiness in facial expression modalities [38–40,73]).

3.4. Vocal communication

Recently, it has also been emphasized that compassion is communicated through the voice. Participants were asked to communicate different emotion states with brief non-word utterances (vocal bursts). Vocal bursts of compassion were then presented along with those of 12 positive states, including love and gratitude. Observers were often able to identify the emotion (including compassion, love and gratitude) being expressed [5].

In summary, compassion appears to be more readily communicated through touch and possibly the voice. These findings are in line with the primacy of touch early in infant development [41]. Given the lower accuracy rates of recognizing compassion

relative to other emotions, in particular with facial displays, the interpretation of the expression of compassion may prove to be more context-dependent than other emotions.

4. Neural correlates of compassion, acupuncture, self-appraisal and reward

4.1. Compassion

It has been suggested that the experience of compassion is associated with increased care and concern for others, reduced focus on one's own needs, and a desire to help others for their own sake. This is supported by studies demonstrated that the momentary experience of compassion motivates altruistic and caring behavior [5]. If so compassion, like pain, is likely mediated by distinct physiological mechanisms that are linked to the interoceptive system [20,74]. This would also suggest that an emotional state and or the effects of a treatment may be assessed by monitoring autonomic tone [42–44]. Interestingly, compassion has been shown to be associated with heart-rate deceleration (parasympathetic activation), whereas heart rate acceleration has been shown to occur in situations that induce distress states, such as fear (sympathetic activation) [45,46]. In experimental studies, children were exposed to three films: one distress-inducing film and two compassion-inducing films. It was reported that during the distress induction film, heart rates increased, whereas they decreased during the compassion induction films [47–49]. Furthermore, children who presented marked heart rate deceleration were more willing to help others. This was interpreted as a sign of compassion [50]. Similar findings have been reported in adults [51]. It has also been reported that the vagal nerves of the parasympathetic nervous system are central in attachment and care giving behaviors [52–54]. Activation of the vagus nerve is inferred from measures of the degree of respiration-linked variability in the heart rate, or respiratory sinus arrhythmia (RSA) [55]. A study of RSA during exposure to emotional stimuli suggests that vagal activity is associated with state-like episodes of compassion [55,75], as high levels of RSA while watching slides was positively related to self-reporting of experienced compassion. These results, when taken together with the compassion-related decelerated heart rate, suggest compassion is associated with parasympathetic activation, whereas distress- and sadness-related heart rate acceleration and increased skin conductance suggest that these two emotions are associated with sympathetic activation [56].

4.2. Acupuncture

Acupuncture treatment involves the insertion of thin needles into the skin and underlying muscle and the subsequent stimulation of the needles manually or electrically. Thus, acupuncture stimulates the somatic afferent nerves of the skin and muscles. During sham acupuncture, a blunt sham acupuncture needle is used that touches the skin, i.e., sets up activity in cutaneous afferents. The somatic sensory information from the body is carried to different parts of the brain, including the limbic structures, the somatosensory cortex and the prefrontal cortex. Somatic sensory fibers also project to various nuclei at the brain stem and hypothalamus. Acupuncture, via somato-autonomic reflex, may modulate the gastrointestinal motility system [57]. Studies by Hui et al. have shown that acupuncture stimulation induces deactivation of a limbic-paralimbic-neocortical network (LPNN) as well as activation of somatosensory brain regions. In a study published in 2009, they explored the activity and functional connectivity of these regions during acupuncture vs. tactile stimulation and vs. acupuncture associated with inadvertent sharp pain. Clusters of deactivated regions in the medial prefrontal, medial parietal and medial temporal lobes, as well as activated regions in the sensorimotor and a few paralimbic structures, were identified during acupuncture. Importantly, these clusters demonstrated virtual identity with the default mode network and the anti-correlated task-positive network in response to stimulation. In addition, the amygdala and hypothalamus were frequently involved during acupuncture. On the other hand, when acupuncture induced sharp pain, the deactivation was attenuated or became activated instead. Tactile stimulation induced greater activation of the somatosensory regions but less extensive deactivation of the LPNN. The results of a study by Hui et al. indicate that acupuncture mobilizes the anti-correlated functional networks of the brain to mediate its actions and that the effect is dependent on the psychophysical response [58]. Interestingly, Immordino-Yang et al. studied strong feelings of compassion for both social pain and physical pain in others. Both feelings involved an expected change in activity in the anterior insula, anterior cingulate, hypothalamus, and midbrain, but the researchersalso found a previously undescribed pattern of cortical activity on the posterior medial surface of each brain hemisphere, a region involved in the default mode of brain function and implicated in self-related processes. Compassion for social pain in others was associated with strong activation in the interoceptive, inferior/posterior portion of this region, while compassion for physical pain in others involved heightened activity in the exteroceptive, superior/anterior portion. In addition, activity in the anterior insula related to compassion for social pain peaked later and endured longer than that associated with compassion for physical pain [59]. This would suggest that both compassion and acupuncture may have a greater effect on the affective components compared to the sensory components of a condition.

Another brain area with a possible key role in compassion and acupuncture is the midbrain periaqueductal gray (PAG). This phylogenetically old area supports maternal-infant attachment behaviors, suggesting that this region may be involved in a caregiving orientation towards those who are vulnerable or suffer, motivating compassionate responding. PAG has also been demonstrated to play an important role in mediating the effects of acupuncture [60]. A key role for PAG is supported by a recent fMRI study examining neural activation whileexperiencing compassion. Compassion induction was shown to be associated with activation in PAG. Pride induction, on the other hand, engaged the posterior medial cortex, a region that has been associated with self-referent processing [61].

4.3. Self-appraisal

When a patient seeks a therapist, there are expectations of a specific effect. These expectations are partly based on self-relevant phenomena and self-referential introspection and constitute the results preference. In addition, when asked about the effect of the treatment, processes that orientate pre-attentive anticipatory or mnemonic information and processes that mediate self-reflection and recollection are integrated together with sensory detection to enable a decision about the patient's perception of the effect of acupuncture treatment. These "self-appraisal" processes are dependent on two integrated networks: a ventral medial prefrontal cortex–paralimbic–limbic "affective" pathway and a dorsal medial prefrontal cortex-cortical-hippocampal "cognitive" pathway [62]. Appraisals of the relevance of the other to the self are also critical in the elicitation of compassion and may specifically engage mid and ventral areas of the medial prefrontal cortex (mPFC) [63–65]. Two recent studies of compassion lend credence to this line of thinking [59,66], as both studies reported increased blood oxygenation level dependent (BOLD) activation in the mPFC.

4.4. The reward system

In Japanese acupuncture therapy, careful fine needling technique with comfortable subjective sensation is considered important. The role of polymodal receptors (PMRs) has been stressed based on the facts that PMRs are responsive to both acupuncture and moxibustion stimuli. Thermal sensitivity is essential in moxibustion therapy, and the characteristics of acupuncture points and trigger points are similar to those of sensitized PMRs. Acupuncture and moxibustion are also known to affect neurons in the brain reward systems [67]. The role of rewarding experiences and their involvement in compassion is theoretically very important, for it would point to a central nervous system process involved in the cost-benefit analyses, wherein the benefits of helping are appraised as outweighing the costs. It is intriguing to note that in a "looking at sad facial expressions" study, self-reports of compassion towards the sad faces predicted greater activation in dopaminergic reward signaling areas (substantia nigra and ventral tegmental area). This finding provides evidence that there is an intrinsic reward to compassion, one that could help outweigh any costs or risks perceived associated with the helping behavior.

5. Compassion a lesson to be learned?

One question is whether the cultivation of state-like episodes of compassion can develop into more enduring compassion-based sentiments or traits. Numerous meditation practices attempt to cultivate the compassionate disposition in loving kindness exercises, in which the individual contemplates feelings of compassion toward individuals close to the self (or the self) and gradually extends those feelings to less close individuals and eventually adversaries and all sentient beings [68]. These loving kindness meditations have been found to shift the resting lateralization patterns in the brain to the left frontal lobes and to lead to boosts in overall well-being and social connection [69]. These studies suggest that mindful experiences of compassionate states increase trait-like tendencies toward feeling compassion. Interestingly, trait-like tendencies toward self-compassion predict increased psychological functioning and reduced symptoms of anxiety, depression, and rumination [70].

Feeling and being able to cope effectively with a situation at hand is central to the elicitation of compassion. If one does not feel able to cope, then one is more likely to feel distress and anxiety. If emotional regulation capacities are diminished, such as following cognitive load or fatigue, compassion may decrease and be replaced by distress in response to the suffering of others, likely resulting in a poor interaction with the patient. Likely, the therapist with the best-reported result is more compassionate compared to the therapists with poorer reported outcomes. Compassion involves appraisal processes attuned to undeserved suffering, signaling behavior related to care-giving patterns, for example, touch and interventions such as acupuncture needling, and a phenomenological experience and physiological responses that orient the individual to social interaction and provide a therapeutic context that mediates healing. Compassion may be perceived as a key factor in forming the therapeutic relationship, i.e., the attachment between the patient and the therapist.

Over the past decade, there has been a dramatic increase in the clinical application of attachment theory. Recently [71] reviewed John Bowlby's attachment model of therapeutic change, the therapeutic relationship, and the therapist's role in emotional healing. According to Bowlby's model, there are three key propositions:

First, a patient's sense of security during therapy is crucial for facilitating therapeutic work.

Second, a therapist's own sense of security contributes to positive therapeutic outcomes.

Third, attachment insecurities can be effectively reduced in therapy, and movement toward greater attachment security is central to achieving favorable therapeutic outcomes.

Taken together, the evidence from the studies supports the importance of establishing a secure base within a therapeutic relationship. Compassion may be one way of establishing this state. It is tempting to suggest that compassion may be one important factor related to the therapist accounting for the non-specific effects of acupuncture. As "placebo" acupuncture is an effective treatment modality in its own right, this effect could possibly be termed specific non-specific, as it likely has a unique biological base.

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