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Impact of Chronic Somatoform and Osteoarthritis Pain on Conscious and Preconscious Cognitive Processing

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Abstract: **The study investigates the impact of chronic pain (CP) on conscious and preconscious cognitive processes and on guessing behavior and examines the mediating effect of a depressive state. Twenty-eight patients with CP due to hip osteoarthritis, 32 patients with a somatoform disorder including pain symptoms, and 31 participants who did not have CP were examined within the framework of a modified process-dissociation-paradigm. Neutral, health-threatening, and general threatening stimuli were presented acoustically in a lexical decision task. Parameters of conscious processing, preconscious processing, and of chance were estimated by a multinomial modeling procedure. CP patients with osteoarthritis showed the lowest level of conscious processing and the highest level of guessing behavior. Patients with somatoform pain tended to react preconsciously to health threatening stimuli but overall showed a profile similar to that of control subjects who did not have CP. The impact of the threatening quality of stimuli on different levels of cognitive processing was weak. Depression did not mediate between the experience of pain and estimates of conscious and preconscious processing.**

Perspective: ***The impact of CP on preconscious and conscious cognitive processing depends on types and causes of pain. The experience of CP caused by inflammation or physical damage tends to reduce the probability of conscious processing and to provoke memory biases. CP in the context of a somatoform disorder appears to have less impact on cognitive functions.***

Key words: *Chronic pain, cognitive processing, implicit memory, process-dissociation-paradigm, somatoform disorder.*

There is evidence of a cumulative impact of chronic pain (CP) on several levels of cognitive functioning including attentional and memory processes.[3,11,12] Cognitive deficits due to CP are relevant with respect to both assessment and medication of CP patients. Many patients with pain-related disability or need for compensation or early retirement due to CP complain about attention deficits or memory deficits.[39,15] As a result, physicians and other therapists have to assess the impact of CP on their patients' cognitive functioning and consider these results in their clinical assessments and therapeutic strategies.

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Pincus and Morley[31] reviewed 23 studies on attention bias, interpretation bias, and memory bias in CP patients. Attentional bias occurs when a CP-patient's response to a defined group of stimuli is disrupted or facilitated due to a cognitive schema of pain or health. According to Pincus and Morley,[31] findings from 11 experiments with the emotional Stroop or dot-probe tasks show varying results. The hypothesis that CP biases attention toward pain- or health-related stimuli was not consistently confirmed. There was evidence that the attentional bias toward pain-related stimuli was affected by anxiety rather than by pain.

Studies of the interpretation bias in processing pain- or health-related stimuli use homophone or homonym tasks or word stem completion tasks. In these tasks, ambiguous stimuli of pain or health are presented without contextual information. A higher rate of pain-related or health-related interpretations of ambiguous stimuli is interpreted as falling back on the internal predominant accessible cognitive schema of pain or health. Previous studies support the hypothesis that CP patients tend to

generate specific responses to pain- or health-related stimuli.[13,31]

There is robust evidence for a memory bias and interference with conscious encoding and rehearsal processes in CP patients. Kuhajda et al[24] and Brown et al[1] found evidence for a delay in the encoding phase in CP patients. According to Dick and Rashiq[7] and Ling et al,[25] processes of maintaining and rehearsal are disrupted in CP patients. However, it is not clear whether memory biases in CP patients are specific to pain-related contents and whether mood influences the process.[31] Overall, the given studies show consistent impact of CP on interpretation and memory processes. The impact of CP on fast (preconscious) attentional processes seems questionable.

One problem in interpreting these studies is that the majority of the used methods do not integrate conscious processes (ie, interpretation, rehearsal, retrieval), preconscious processes (subliminal attention), and chance-bias (guessing) into a consistent model of cognitive processing. Test scores of the Stroop-test, of dot-probe tasks, of stem completion tasks, and of memory achievement tests are of limited benefit if the aim is to disentangle different levels of cognitive processing. Grisart et al[16] criticized that results on explicit memory tests overestimate the role of conscious processes whereas the impact of preconscious processes will falsely be ignored. As a result, they used a process-dissociation procedure[22] that enables researchers to assess conscious and preconscious processes, based on a consistent model of cognitive processing. Although they did not find a significant bias of CP on preconscious processing, we share the view that a consistent theoretical framework is necessary to describe the potential impact of CP on cognitive processing.

Possibly, the equivocal results about the impact of CP on cognitive processing might be explained by diagnostic features of CP syndromes. Preconscious processing seems to be biased predominantly in patients with chronic somatoform pain or patients with elevated emotional disturbance.[8,26,37] In contrast, studies of experimental pain or CP caused by physical damage fail to show either an impact of pain on preconscious processes[16] or an impact of preconscious processes on pain.[42] The impact of pain on chance-bias, which is affected neither by conscious nor by preconscious processes, has been widely neglected so far. According to Hecker et al,[18] a chance-bias is expected to reflect a higher level of affect-related cognitive confusion or exhaustion. There is evidence that affective factors such as depression mediate the relationship between pain and memory in CP patients.[1,17] When analyzing the impact of CP on cognitive processing, the mediating effect of depression must be taken into account.

The aim of the study was to test relations between different types of CP and conscious, preconscious, and guessing processes in a memory task. CP patients are expected to show lower levels of conscious processing compared with non-CP control subjects because of the disrupting effect of pain on the central executive function (hypothesis 1). In patients with CP symptoms embedded in multiple somatoform symptoms, a preconscious bias to health-related or threat-related stimuli is predicted because of stronger schema-guided facilitation or inhibition (ie, preconscious processing) of threatening stimuli (hypothesis 2). An elevated chance bias is expected to occur in CP patients because the resource-demanding character of CP will lead to cognitive confusion and random behavior (hypothesis 3). Finally, negative affect is expected to mediate between pain and cognitive processing (hypothesis 4).

Methods

Participants

Recruitment of Participants

A sample of 91 volunteers was assessed, with 28 participants diagnosed as CP patients with osteoarthritis (OA) of the hip, 32 patients with a somatoform disorder including pain symptoms (ICD10: F45.x), and 31 control subjects who did not have CP.

Patients with pain caused by OA were outpatients of 2 medical health care centers. They had clinical findings and radiographic changes diagnostic of that disorder and had complained of pain for at least 6 months. Originally, 38 OA patients were asked by their physicians whether they were willing to participate in the study about aspects of information processing.

All patients with a somatoform disorder including pain symptoms were inpatients of a psychosomatic clinic. Based on results of medical examinations at the beginning of their stay, 35 were asked whether they were willing to participate in the study. No information was collected about patients' reasons to decline participation. The assessments were conducted within the first week of in-patient treatment to avoid additional treatment effects.

Healthy control subjects were recruited by an announcement in a local newspaper and by announcements on notice boards in the University of Bonn. To homogenize the samples with respect to age, 5 participants older than 65 years were excluded from the OA-pain group. The study was approved by the institutional review board at University of Bonn, and all participants signed informed consent before undergoing study-related evaluations.

To describe the samples, the following instruments were used:

- International Diagnosis Checklists for ICD-10 (IDCL).[20]
- Screening for Somatoform Disorders (SOMS).[33] The questionnaire consists of 68 items of bodily symptoms that are associated with somatization and classification criteria of somatoform disorders. The test score indicates the tendency to report symptoms that might be relevant for the diagnoses of a somatoform disorder. Reliability scores are $\alpha = .88$ for internal consistency and $r_{tt} = .85$ for retest. In the present sample, reliability scores ranged from $\alpha = .79$ (healthy control subjects) to $\alpha = .87$ (OA-group) to $\alpha = .90$ (somatoform group). Validity of the test score has been shown for results of structured clinical interviews, personality inventories, and SCL-90-R.