Dissociative Identity Disorder and the Brain: A Brief Review

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Dissociative identity and depersonalization disorders are characterized by disruptions in the experience of self. Understanding the brain functions involved in these disorders is important to understanding the processes of self-experience in the human brain. A review of the published neurological research implicates different bilateral and particularly temporolimbic abnormalities in the mechanisms of dissociation and depersonalization. Further research employing technologically advanced high resolution imaging and larger samples is needed to clarify and enhance the current evidence.

Disociative disorders are marked by disruptions of memory, consciousness, identity, and the perceived environment. Dissociative identity (DID) and depersonalization disorders (DPD) relate particularly to dysfunctions in one's sense of self. In DID this is categorized by a splitting of the elements of the self into two or more personality states within one individual (American Psychiatric Association, Diagnostic and Statistical Manual-IV, 1994). These distinct identities recurrently control the individual's behavior, displaying their own separate patterns of perceptions and thoughts in relation to themselves and their environment, often in contrast with the characteristics of the primary identity. As a result, individuals with DID experience memory gaps of events and situations throughout their lives. In DPD, individuals experience recurrent or persistent feelings of detachment from their body or their mental processes. This is often accompanied by derealization, a sense that the world outside is unreal or strange to them. In contrast to schizophrenia, intact reality testing is maintained in individuals with DPD.

In manifestations of both DID and DPD seen in patients following mild traumatic brain injury, CT scans and electroencephalogram (EEG) showed no evidence of focal lesions, while single-photon emission computerized tomography (SPECT) did show some bilateral abnormalities suggesting diffuse cerebral hypofusion (Grigsby 1986 and Cantagallo, Grassi, & Della Sala, 1999). In both cases some left hemispheric dysfunction is suggested in one participant's poor verbal performance (Grigsby) and in another participant's SPECT results (Cantagallo et al.). More specific localization may have appeared with the use of higher resolution technology such as magnetic resonance imaging (MRI). In an early study by Coons, Milstein, and Marley (1982), EEG of two DID patients and their alter states showed differences in right hemisphere recordings. When the control participant simulated different affectations, the EEG results showed even greater differences in right hemisphere recordings. The researchers commented that their results suggest that

differences in personality states in DID are based on changes in affect and concentration, such as the control manifested in his simulations, rather than on inherent brain differences.

However, because the readings from the control participant reflected greater changes than the readings from the DID participants, it seems that inherent brain function differences may actually have played a role. Further studies with EEG and higher resolution technology have shown such differences in DID and DPD participants. Abnormalities in the left hemisphere, particularly temporal, are implicated in much of the research in DID and DPD. Hollander and colleagues (1992) studied a participant with DPD using brain electrical mapping (BEAM). The results suggested some diffuse dysfunction, but more so in the left temporal areas, which had a prominent increase in evoked potential negativities as well as in theta and anteriorized alpha activities. Although MRI of the participant's brain was within normal limits, SPECT demonstrated dysfunctional perfusion in the left caudate. In positron emission tomography (PET) and MRI studies of DPD participants, Simeon and colleagues (2000) found more active sensory association areas in the left hemisphere, with increased metabolic rates in the left parietal and occipital regions. An increase in metabolic activity particularly in Brodmann's area 7B showed a significant positive correlation with participants' dissociative and depersonalization scores.

The left frontal and right and left temporal areas may be involved with the phenomena of multiple personalities. In 12 participants with left or right temporolimbic epilepsy, 7 manifested clinical signs consistent with multiple personalities, and 5 suffered illusions of possession (Mesulam, 1981). Lee, Loring, Meador, Flanigin and Brooks (1988) used the intracarotid amobarbital sodium procedure (IAP) on 92 participants and reported that of those 92 tested, all five who displayed severe behavioral responses from right hemispheric inactivation had structural lesions in their left hemisphere. Also using IAP Ahern, Herring, Tackenberg, Seeger, Oommen, Labiner, et al. (1993) studied two participants with left temporolimbic epilepsy. Through IAP they were able to replicate the ictal and postictal altered personality states that had been reported previously by the patients and their families. Both of the participants' alter shifts were induced by inactivation of the left hemisphere, with no EEG evidence of seizure activity at the time. In one of these participants, his previously reported preictal altered state-—delusions of being Jesus imprisoned in Hell-—was induced by right hemisphere inactivation. One implication is that predominant personality states in these participants may relate to hemispheric balance. While these participants did not experience the memory loss and dissociation involved with alter-switches in DID, further studies of such neurologically based DID-like symptoms may lead to a better understanding of the brain functions involved in relation to the personality states of DID.

SPECT studies reported a significant blood flow increase in DID patients' left temporal areas versus control areas, as well as a similar increase in DID patients versus normal participants (Saxe, Vasile, Hill, Bloomingdale, & Van der Kolk, 1992; Sar, Unal, Kiziltan & Ozturk, 2001). DID participants (n= 2), a control group, and

patients diagnosed with hysteria were given a battery of neuropsychological tests, including the Wechsler Adult Intelligence Scale (WAIS-R), and EEG readings (Flor-Henry, Tomer, Kumpula, Koles and Yeudall, 1990). In both participants with DID, left hemisphere activation was pronounced in all conditions, as opposed to the controls where hemisphere activation was task-dependent (left: language; right: spatial), and the hysterics, where right hemisphere activation was reported.

Hughes, Kuhlman, Fichtner and Greunfeld (1990) studied EEG brain maps of a DID patient and found bilateral abnormalities present in their participant's temporal lobes, to a greater degree on the left. The researchers compared the topographic maps of their participant's core personality versus those maps of a number of her alters. The results showed differences in left or right temporal areas between the participant's core personality and her alters, in varying degrees depending on the specific alter personality. No differences were seen in the maps of the participant's core personality and those of the participant while pretending to be characters similar to her alters, and no differences were seen in those of an actress performing the same roles. The participant's psychiatrist, blind to the mapping results and familiar with the participant's different personalities, was asked to rank the alters in four groups, as they related in similarities to the core personality.

Some of the beta 2 frequency changes Hughes et al. (1990) found on the left temporal and temporal-parietal-occipital areas are similar to findings reported in schizophrenics. Orbito-frontal hypofusion reported by Sar et al. (2001) in their DID participants has also been seen in schizophrenic participants (Andreasen, Swayze, Flaum, O'leary and Alliger, as cited in Sar et al.). These similarities may help explain the fact that some DID patients have initially been diagnosed with schizophrenia (Flor-Henry et al., 1990). Both participants in this study displayed dominant left temporal and bilateral frontal dysfunction before treatment. One of those participants was tested after successful treatment of DID. Although still displaying evidence of frontal dysfunction, the post-treatment test results no longer showed evidence of dysfunction in her left temporal area.

Tsai, Condie, Wu, and Chang (1999), used functional magnetic resonance imaging (fMRI) in a DID patient. The results showed a significantly smaller volume in the participant's right hippocampus, although her total intracranial volume was within normal limits. This is similar to the decreased hippocampal volume seen in Alzheimer's patients, which may relate to the memory gaps in DID patients. These results are also consistent with reports of hippocampal reduction in patients with PTSD, both of which reflect the long-term effects of stress on memory, especially on hippocampal processes, as seen in previous animal studies (Sapolsky, as cited in Tsai et al., 1999). Tsai and colleagues' DID participant scored in the normal range on the Wechsler memory scale, indicating that she did not have functional memory impairment. This supports the concept that DID and related PTSD stemming from childhood abuse do not necessarily have the same effects on the brain as seen in combat-related PTSD, where a decrease in right hippocampal

volume has been reported along with correlated deficits in short-term verbal memory (Sapolsky, as cited in Tsai et al., 1999).

As is often the case with DID, all of the participants in Sar et al. (2001) fit the diagnostic criteria for several different psychiatric disorders as well. Tsai et al. (1999) had a similar confounding aspect in their fMRI study of a DID patient comorbidly presenting with PTSD, pointing out that it is virtually impossible to find a DID patient who does not fit the criteria for at least one other disorder. MRI research has shown a reduction in left hippocampal volume in participants reporting childhood sexual victimization and/or related PTSD (Bremner et al. and Stein et al., as cited in Sar et al., 2001). PET and cerebral blood flow (CBF) studies were done with other participants who have reported extensive childhood abuse and victimization, who do or do not manifest PTSD, and who do not manifest symptoms of DID (Rauch et al. and Shin et al., as cited in Sar et al., 2001). These studies implicate different regions than the left hemispheric regions prevalent in the studies of DID participants. Further research may help determine the extent to which left temporal dysfunctions may be related specifically to the phenomena of dissociation and not attributed to the participants' traumatic childhood experiences and comorbid sympomatology.

The role of stress in dissociative disorders can be seen in research of the hypothalamic-pituitary-adrenal axis (HPA) in DPD patients (Simeon et al., 2001). These studies demonstrated different results, one showing an increase and one showing a decrease in relation to depersonalization, but this might be due to the different techniques used (measuring cortisol levels in blood versus saliva) and to the relatively small sample sizes in both studies. Despite these discrepancies, the implications are the same; DPD and possibly other primary dissociative conditions are linked with changes in HPA activity and cortisol levels. Furthermore, when depersonalization was induced by the seratonin agonist meta-chlorophenylpiperazine (m-CPP), an increase in depersonalization scores correlated with an increase in anxiety and depressive symptomatology (Simeon, Hollander, Stein, DeCaria, Cohen, Saoud, et al. 1995). Stress also plays a role in DID, as switching to and from alters often occurs in response to a stressful situation (Beere, 1996). More studies on this relation between stress and dissociation are needed to determine if the anxiety and depression found in Simeon and colleagues' study was in response to administration of m-CPP or to the resulting depersonalization.

Interesting implications can be found in some studies not directly on dissociative disorders, but involving activation of related experiences and possibly related brain functions. Out-of-body experiences (OBEs) were repeatedly induced by electrical stimulation of the right angular gyrus (Blanke, Ortigue, Landis, and Seeck, 2002). Due to the proximity of the vestibular cortex, the researchers suggest that dissociative self/body experiences such as OBEs may relate to an integrative failure in complex vestibular and somatosensory processing. This is consistent with Simeon and colleagues findings in DPD participants that demonstrated an extensive pattern of metabolic activity in major somatosensory and association areas (2000).

Lehmann, Faber, Achermann, Jeanmonod, Gianotti, and Pizzagalli (2001), recorded EEG and low resolution electromagnetic tomography (LORETA) from a participant in advanced meditation, demonstrating some interesting results that may be relevant to dissociative disorders. Self-dissolution meditation involves what the participant described as concentrating ''on the experience of dissolution of the self into a boundless unity (emptiness)'' (p.112). Distinctly different from readings of the visualization and mantra-chanting meditations, in which task-related activation was seen (right posterior and left central, respectively), the readings during self-dissolution showed activation only in the right superior and anterior areas of the frontal gyrus. This region has been implicated in various studies regarding self-awareness and self-recognition (Fink et al., Craik et al., Vogeley et al.; and Keenan et al. as cited in Lehmann et al., 2001), and may play an important role in the dysfunctional self experiences of dissociative disorders.

Abnormalities in the right hemisphere are represented in the brain studies of dissociative disorders. When symptomatology of DPD was induced through administration of tetrahydrocannabinol (THC) CBF increased globally (Mathew, Wilson, Chiu, Turkington, Degrado, & Coleman, 1999). However, this increase was greater in the right hemisphere, particularly frontal and the anterior cingulate. A positive correlation between depersonalization scores and right frontal and anterior cingulate CBF increase was found. Measuring CBF in a DID participant, Mathew, Jack, and West (1985), found an increase in right temporal activation in the alter versus in the primary personality state. In the fMRI results found by Tsai et al (1999), the switching process from one alter to another involved a bilateral reduction in hippocampal and medial temporal activity, more so on the right side, as well as in small regions of the substantia nigra (SN) and globus pallidus. When the participant switched from an alter back to the core personality state, fMRI showed activation only in the right hippocampus. Guided imagination of irrelevant personality states did not evoke significant change. These results imply that the processes of dissociation and personality-state switching in DID patients has a strong hippocampal involvement, consistent with the left and right temporal abnormalities and changes that are reported in many neurological studies of DID patients (Ahern et al., 1993; Flor-Henry et al. 1990; Hughes et al., 1990; Sar et al., 2001; Saxe et al., 1992; and Tsai et al., 1999).

The results in Tsai et al. (1999) are from a limited single case report and could reflect a compensatory hippocampal response to some other primary deficit not detected by fMRI. These results are also limited by the fact that this was a patient already in the process of psychotherapeutic treatment for years and that the switches were consciously induced. The need to consciously induce switching for the sake of test reliability does eliminate some interesting possibilities. Spontaneous alter shifts often occur as a result of stress (Beere, 1996). FMRI brain imaging during such a shift might thus show specific involvement of the amygdala, not just the general temporal lobe or hippocampal activity already seen. Tsai and colleagues also found a bilateral reduction in a small part of the

substantia nigra (SN), which is implicated in the processes of movement and posture. Perhaps a person with DID experiences a very quick and subtle shutting down of the body's positioning while switching occurs, preparing for the new identity state to take control. However, these results may have nothing to do with the switching process. Further investigation may help determine what role, if any, the hippocampus, amygdala and SN do play in alter shifting and dissociation.

Conclusions

The brain areas related to somatosensory processing are implicated in DPD, consistent with the symptomatology of feeling detached from oneself. In DID, a disorder characterized to a great extent by issues of memory, the hippocampus probably plays a strong role, which neurological research is beginning to demonstrate. Because of the implications of the hippocampus in the switching process, Tsai and colleagues (1999) suggest that bringing forth and integrating a patient's memories may be key to successfully treating and integrating the alter personality states in a DID patient. This is consistent with the notion to date that the most successful treatment for DID is long-term psychotherapy and in particular psychoanalysis, a therapeutic process in which memory plays an important role.

Some of the dysfunctional brain processes implicated in DID and DPD studies may be different; however, the similarities between them and with other self-related findings and phenomena are intriguing. Research to date suggests a strong bilateral temporolimbic involvement, with different implications in the left versus the right dysfunctions. Further studies are needed to better clarify the role of the limbic system, the hippocampus, and possibly the amygdala in these disorders. Although these disorders are rare, due to the nature and intensity of dysfunctions in the participantive experience of self, further neurological research on dissociation may present information not only applicable in relation to these disorders, but to the further understanding of the brain and the human experience of self.

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