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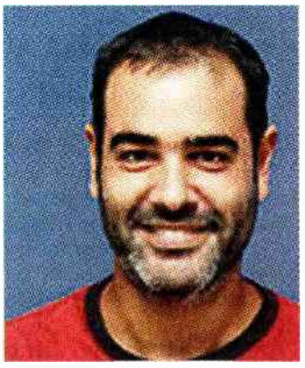
FIRST IN THE WORLD:

TA researchers find some patients in vegetative state can react to emotional stimuli

• By JUDY SIEGEL



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(Tel Aviv Medical Center)

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Although people in a vegetative state due to extensive brain damage are unable to speak, move their eyes or react to pain, research at Tel Aviv Sourasky Medical Center on four patients in such a condition shows that their brains may be able to react to "emotional stimuli" such as recognizing familiar faces.

This has just been shown for the first time in the world, published in the open-access journal *Public Library of Science (PLoS)* and presented to conferences on consciousness held in Japan and England.

Vegetative-state patients are not those who have suffered lower-brain death and whose respirators are turned off and considered candidates for donating organs.

The brain activity of the four vegetative state patients was compared with that of 13 healthy patients, eight of them women, using functional MRI scans.

Dr. Talma Hendler, Dr. Haggai Sharon, Dr. Yotam Pasternak and others at Sourasky's Functional Brain Center and Tel Aviv University's Sackler School of Medicine said the research makes it possible to understand the condition of patients in a vegetative state and, they hope, may make it possible eventually to treat and rehabilitate these severely ill patients.

The most famous Israeli in a vegetative state is former prime minister Ariel Sharon, who has been lying in bed at Sheba Medical Center at Tel Hashomer for some eight years after suffering devastating strokes in Jerusalem. The Sourasky researcher would not say whether he and his team examined or tested the former prime minister for the study.

He estimated that in Tel Aviv alone, there may be some 100 vegetative state patients. There are no official nationwide Israeli statistics, but in the US, it has been reported that there are some 14,000 new cases per year. Between 10 and 30 percent of vegetative state patients eventually regain consciousness.

"This is really a new condition," Sharon told *The Jerusalem Post*, because years ago, their physical conditions could not be repaired and they were clinically dead. Now we can resuscitate them, but they remain in a vegetative state. Although the study teaches more about them, there still is no treatment, but "eventually, it may be possible to perform deep-brain stimulation using implants in their heads, or sensory rehabilitation."

Until now, only one case-report and two fMRI (functional magnetic resonance imaging) studies have applied a simple emotional stimulus in vegetative-state patients, by using the sound of the patient's name spoken in a familiar voice. These studies documented isolated cortical activations in a few vegetative state patients, but the lack of control stimuli of unfamiliar voices and the fact that brain processing of one's own name may be entirely automatic critically limit the interpretation of such findings, the Israeli authors noted.

The Tel Aviv study, however, showed for the first time that patients in such a severe state may have "emotional awareness" of their surroundings. They are fed through a tube but breathe on their own and even show cycles of sleep and wakefulness. But despite this, they do not react at all to speech or pain, and especially do not communicate or show any sign of awareness of themselves.

The researchers tested the brain's reactions of the four to seeing unfamiliar faces and the faces of close relatives and friends and photos of his own face using fMRI, which makes it possible to detect and follow brain functioning in real time and compare the reactions to those by healthy controls.

They found that the patients' remaining brains can distinguish between faces and other objects in the external world. This is new, said Sharon, because "until now, it was not known whether the cognitive abilities of these patients make it possible for them to absorb complex stimuli in the environment and differentiate between various types of stimuli such as faces versus inanimate objects." The researchers called this "covert awareness."

The brain researchers showed looking at familiar faces caused the activation of brain centers responsible for processing of emotional values and autobiographical memories. This is a very complex process, he said, and involves absorbing the visual stimulant, deciphering its content and creating associations to specific human memories. Measurement of the connectivity among these areas showed that vegetative patients in fact work in a coordinated network fashion similar to healthy controls.

The next question was whether automatic brain processing was witnessed or whether the patients were aware of their environments, said Sharon. In the second part of the experiment, the patients were asked to carry out active mental activity, trying to imagine their parents' faces. This can be identified via fMRI. Surprisingly, one of the four patients was able to carry out this complex brain activity in the same way that healthy controls do, while a second patient did it partially.

The research showed that "at least some of the vegetative patients not only have emotional awareness of their surroundings but also are able to create emotional activation through internal processes, as we all do while thinking and daydreaming," Hendler said.