Evaluation and Rehabilitation of Cognitive and Motor Functions in Post-Coma Patients through Technological Setups: A Literature Overview

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Caregivers and professionals working with post-coma patients caused by acquired brain injuries and diagnosed with severe to profound multiple disabilities or consciousness disorders are usually requested to tackle two relevant questions. First, they should evaluate whether the person is in a vegetative state, in a minimally conscious state, and/or emerged/emerging from it. Second, they could be asked to design and plan a rehabilitative intervention with adaptive behavior, person's active role, and constructive engagement perspectives [1-2]. An early differential diagnosis may be considered crucial for prognostic purposes. Beside a neuropsychological assessment based on behavioral scales (e.g., Coma Recovery Scale-Revised), event-related brain potentials (e.g., P300 and mismatch negativity), and functional magnetic resonance, one may envisage the use of assistive technology-based setups (AT), which rely on learning principles (i.e., causal association between behavioral responses and environmental consequences) [3-4].

AT includes any piece, device, equipment or tool capable of ensuring a post-coma person with consciousness disorders and multiple disabilities with an independent access to positive and requested stimulation [5-6]. Thus, AT fills the gap between the human skills and resources and the environmental requests [7-8]. Accordingly, AT-based programs may be viewed as critical means to pursue the dual aforementioned diagnostic and rehabilitative objective [9-10]. For instance, a learning setup may be useful to assess whether the initial evaluation of a vegetative state should be confirmed or a more favorable outcome (i.e., minimally conscious state) may be proposed [11]. Furthermore, a computerized system with an adapted software and specific sensors may be implemented to provide the independent access to desired items [12]. Although the literature along the last two decades (i., e., 2000-2020) is robust [13-18], only two review papers are available [19-20].

In light of the above, the first goal of the current article is to provide the reader with an updated overview of the empirical contributions available on the use of AT setups for both evaluation and rehabilitation objectives along last decade. The second goal is to emphasize strengths and weaknesses of the reviewed studies. The third objective is to recommend some useful guidelines and helpful insights for both research and practice. Fifteen studies were reviewed and four main categories of equipment were identified, namely (a) learning setup based on microswitches (i.e., basic form of AT), (b) a combination of microswitch and speech generating device (SGD), (c) computerized systems for leisure purposes with request and choice options, and (d) computerized systems for communication purposes. Results evidenced satisfactory outcomes although few failures occurred. Some research efforts to support assessment and recovery of motor functions were warranted. Clinical, educational, psychological, and rehabilitative implications of the findings were critically discussed. Some useful suggestions for future directions were argued.

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