Post-traumatic olfactory loss: psychophysical, electrophysiological and neuroradiological findings in three single case studies.

Fabrizia Caminiti¹, Rosella Ciurleo¹, Simona De Salvo¹, Placido Bramanti¹, Silvia Marino¹,²

¹IRCCS Centro Neurolesi “Bonino - Pulejo”, Messina, Italy
²Department of Biomedical Sciences and Morphological and Functional Imaging, University of Messina

Introduction:
Traumatic brain injury is one of the main causes of smell disorders [1]. The degree of olfactory loss may vary and depend on the severity, nature and location of injury within olfactory system. We report three single cases of post-traumatic anosmia evaluated by Sniffin Sticks Test (SST), Olfactory Event Related Potentials (OERPs) and Magnetic Resonance Imaging (MRI) examinations. The relationship among psychophysical, electrophysiological responses and presence/absence of olfactory system lesions, detectable by craniofacial MRI, was evaluated. Moreover, the usefulness of OERPs as tool for a more objective/quantitative diagnosis of post-traumatic anosmia, especially in absence of olfactory lesions detectable to MRI, has been highlighted.

Materials and Methods:
A preliminary olfactory evaluation was conducted by SST that is based on pen-like odour dispensing devices, which were placed approximately 2 cm in front of both patient’s nostrils. The SST consists of three sub-tests namely for odor threshold, discrimination and identification, the sum of which is defined as “TDI score” (figure 1a) [2]. In addition, a selective stimulation of the olfactory system to elicit the OERPs has been achieved by a computer-controlled Olfactometer (Olfactometer OM2S – Burghart) (figure 1b), linked directly with electroencephalograph. A succession of 40 randomized olfactory stimuli (2-phenylethanol and H2S/N2 4 ppm), was presented through a teflon tube. The duration of each stimulus was 200 ms, and time between stimuli (interstimulus interval, ISI) was 40 s [3]. The cranio-facial MRI detected the presence of lesions compatible with olfactory loss.

Conclusions:
In the olfaction assessment, the combined approach including the SST, OERP recording and MRI examination, has a prominent role to clarify the degree and nature of olfactory deficit and their correlation. OERPs may have a good clinical application in objective diagnosis of post-traumatic anosmia, especially when the neuroradiological examination do not show lesions compatible with olfactory loss.

References

Figure 1. (1a) Sniffin’ Sticks Test (Burghart, Medical Instruments) (1b) Olfactometer (OL023 - Burghart, Medical Instruments).

Figure 2. (a) OERPs showed a reduction of N1-P2 amplitude, but normal latency of the main components on derivations Fz, Cz and Pz. P2. MRI examination of the patient showed the cortical and sub-cortical lesion in the right OFC: (bx) Axial FLAIR image; (by) Axial T2 weighted image.

Figure 3. (a) OERPs showed the absence of all sensory components on derivations Fz, Cz and Pz. The MRI examination didn’t show lesions in olfactory areas: (b) Axial FLAIR image; (b) Axial T2 weighted image.

Figure 4. (a) OERPs showed the absence of all sensory components on derivations Fz, Cz and Pz. A MRI examination showed the only presence of right temporal cortico-subcortical hyperintensities: (bx) Axial FLAIR image; (by) Axial T2 weighted image.

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