

Mismatch negativity in methamphetamine dependence: A pilot study

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The objective of this study was to verify hypothesised changes in event related potentials (visual mismatch negativity, vMMN) in 17 subjects dependent on methamphetamine (MAMP) compared to age and gender matched 17 healthy volunteers. We found a significant correlation between vMMN and duration of methamphetamine abuse (Spearman correlation coefficient $r=0.54-0.78$; $P<0.05$). The positive correlation indicates drop of originally more negative response to deviant stimulus, what may indicate a pre-attentive processing enhancement in the first years of MAMP abuse with its decrease later on. Accordingly, *post-hoc* analysis revealed significantly stronger vMMN in patients with length of MAMP abuse shorter than 5 years than in paired controls. There were no such differences in abusers with the length of abuse longer than 5 years. The results show that the visual processing on the pre-attentive level can be influenced by long-term MAMP abuse, what can be specifically assessed by vMMN.

Key words: methamphetamine dependence, event related potentials, visual mismatch negativity paradigm, methamphetamine neurotoxicity, pre-attentive visual processing

Methamphetamine (MAMP) is a potent central nervous system stimulant which produces dose-dependent euphoria. MAMP is relatively easy to produce and inexpensive to purchase. MAMP increases the extracellular level of dopamine in the nucleus accumbens involved in the reward system (Izawa et al. 2006). Chronic MAMP use leads to oxidative stress, neurotoxicity and neurodegeneration (Kanthasamy et al. 2006).

The total number of drug users in the world is now estimated at some 185 million people, equivalent to 3% of the global population, or 4.7% of the population aged 15 to 64 years. Amphetamines, primarily MAMP and amphetamine, are used by about 30 million people (United Nations 2004). Dramatic increases in MAMP production and addiction have been reported over the last decade e.g. in North America (Barr et al. 2006), Germany (Hartel-Petri et al. 2005) and the Czech Republic (Csémy et al. 2002).

Auditory or visual mismatch negativity (MMN) is a component of event related potentials (ERP) that represents an index of sensory memory. Deficits in MMN generation have been repeatedly demonstrated in chronic schizophrenia (Jessen et al. 2001, Baldeweg et al. 2004), and appeared to be quite specific for schizophrenia (Umbricht et al. 2003). However, MMN has never been studied in MAMP dependence. We found no items in the MEDLINE database using the key words “mismatch AND negativity AND methamphetamine” on 13th February 2008.

The aim of our study was to test the hypothesis that subjects dependent on MAMP significantly differ from age- and gender-matched healthy volunteers in the visual mismatch negativity generation.

Seventeen patients (at age 24.4 ± 4.4 years) dependent on MAMP (DSM-IV Code 304.40) who had been treated at the Mental Hospital in Nechanice (part of University Hospital Hradec Králové) in 2005–2006 participated in the study. 17 age- and gender-matched control group of healthy volunteers (24.7 ± 4.7 years, 3 females) who had never used any illegal psychotropic drug (including MAMP) consisted of staff members

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