

Impulsivity markers in single neurons activity in ventral subthalamic neurons of parkinsonian patients

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Introduction: Parkinson's disease (PD) is a neurodegenerative disease associated with motor dysfunctions, but a large part of PD patients following dopaminergic therapy suffers from impulsive-compulsive behaviours (ICB).

Aims: Tryng to better understand neural dysfunctions underlying mpulsive-compulsive behaviours in patients affected by PD.

Methods: We previously identified ICB markers at the single neuron level in STN [1] and we localized them in the ventral area of the nucleus [2]. We extracted single unit activity from microelectrode recordings (MER) performed at rest and in med off condition during deep brainstimulation (DBS) implant surgery. Recordings were performed in 12 PD patients without ICB (ICB-, 330 neurons) and 12 PD patients with ICB (ICB+, 412 neurons).

Results: Single unit features discriminating between ICB+ and ICB- were: i) firing regularity, ii) intra-burst firing rate and the iii) beta and iv) gamma power of background unit activity. Performance of SVM decoding of ICB based on these features was up to 80% (20/24 subjects). Crucially, when decoding was based only on the regularity of ventral neurons the performance reached 90% (22/24 subjects).

Conclusions: We conclude that ICB in PD patients in med off state are associated with decreased irregularity in ventral STN neurons and that an online MER decoder could be able to identify optimal DBS spot to treat ICB. Furthermore, our results are compatible with the hypothesis that patients developing ICB after dopaminergic treatment have a more preserved baseline in ventral areas. For these patients DBS might be a preferred option from earlier stages of PD.

References:

[1] Micheli F, Vissani M, Pecchioli G, Terenzi F, Ramat S, Mazzoni. A Impulsivity Markers in Parkinsonian Subthalamic Single-Unit Activity Movement Disorders, 16 January 2021

[2] Vissani M, Micheli F, Pecchioli G, Ramat S, Mazzoni. A Impulsivity is associated with firing regularity in parkinsonian ventral subthalamic nucleus Ann Clin Transl Neurol 2022 Apr;9(4):552-557