Speech Intelligibility

The term intelligibility refers to 'speech clarity' or the proportion of a speaker's output that a listener can readily understand. In typical development, as children learn to talk, their comprehensibility to those around them steadily increases.

Subthalamic deep brain stimulation (STN-DBS) is an established treatment for late stage Parkinson's disease (PD). Speech intelligibility (SI) and verbal fluency (VF) have been shown to deteriorate following chronic STN-DBS. It has been suggested that speech might respond favourably to low frequency stimulation (LFS).

Grover et al., examined how speech intelligibility, perceptual speech characteristics, phonemic and semantic VF and processes underlying it (clustering and switching) respond to LFS of 60 and 80 Hz in comparison to high frequency stimulation (HFS) (110, 130 and 200 Hz).

In this double-blind study, 15 STN-DBS PD patients (mean age 65, SD = 5.8, 14 right handed, three females), were assessed at five stimulation frequencies: 60 Hz, 80 Hz, 110 Hz, 130 Hz and 200 Hz. In addition to the clinical neurological assessment of speech, VF and SI were assessed.

Speech intelligibility and in particular articulation, respiration, phonation and prosody improved with LFS (all $p < 0.05$). Phonemic VF switching improved with LFS ($p = 0.005$) but this did not translate to an improved phonemic VF score. A trend for improved semantic VF was found. A negative correlation was found between perceptual characteristics of speech and duration of chronic stimulation (all $p < 0.05$).

These findings highlight the need for meticulous programming of frequency to maximise speech intelligibility in chronic STN-DBS. The findings further implicate stimulation frequency in changes to specific processes underlying VF, namely phonemic switching and demonstrate the potential to address such deficits through advanced adjustment of stimulation parameters [1)].

1)
Grover T, Georgiev D, Kaliola R, Mahlknecht P, Zacharia A, Candelario J, Hyam J, Zrinzo L, Hariz M, Foltynie T, Limousin P, Jahanshahi M, Tripoliti E. Effect of Low versus High Frequency Subthalamic Deep Brain Stimulation on Speech Intelligibility and Verbal Fluency in Parkinson's Disease: A Double-Blind Study. J Parkinsons Dis. 2018 Dec 28. doi: 10.3233/JPD-181368. [Epub ahead of print] PubMed PMID: 30594934.