Subdural to subgaleal EEG signal transmission: The role of distance, leakage and insulating affectors

Objective
To estimate the area of cortex affecting the extracranial EEG signal. Methods
The coherence between intra- and extracranial EEG channels were evaluated on at least 10min of spontaneous, awake data from seven patients admitted for epilepsy surgery work up.

Results
Cortical electrodes showed significant extracranial coherent signals in an area of approximately 150cm² although the field of vision was probably only 31cm² based on spatial averaging of intracranial channels taking into account the influence of the craniotomy and the silastic membrane of intracranial grids. Selecting the best cortical channels, it was possible to increase the coherence values compared to the single intracranial channel with highest coherence. The coherence seemed to increase linearly with an accumulation area up to 31cm², where 50% of the maximal coherence was obtained accumulating from only 2cm² (corresponding to one channel), and 75% when accumulating from 16cm².

Conclusion
The skull is an all frequency spatial averager but dominantly high frequency signal attenuator. Significance
An empirical assessment of the actual area of cerebral sources generating the extracranial EEG provides better opportunities for clinical electroencephalographers to determine the location of origin of particular patterns in the EEG.

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