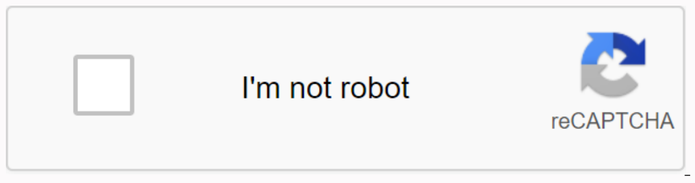

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Polarity worksheet eeg

1. EEG Dr Pramod Krishnan, MD (Int Med), DM Neurology (NIMHANS) Epilepsy Scholarship Polarity Principles (SCTIMST) (LMU, Munich) World Sleep Federation Certified Sleep Medicine Specialist. Consultant Neurologist and Head of The Department of Epileptology St. Neurology, Manipal Hospital, Bengaluru. 2. Introduction • EEG is a graphical representation of the voltage difference between two different scalp locations drawn over time. • The scalp produced by cerebral neurons is replaced by the EEG signal: 1. Electrical conductive properties of tissues between the electrical source and the recording electrode on the scalp. 2. Conductive properties of the electrode. 3. Orientation of the cortical generator to the recording electrode. 3. Skull Skull Aaraknoid mater Subaranoid space Cerebral cortex Pia mater Dura mater Amplifier Electrode Efferent axon Routine scalp spontaneous EEG signal recorded EEG cortical pyramid cell post-synaptic potentials arise. Pyramidal cells Synapses 4. Pyramidal cells have unique biophysical advantages: 1. Synchronized fire (i.e., they sum time) 2. Similar radial orientation (i.e. targeted in the same direction towards the cortical surface). I mean, it's better to sum it up. 3. Their potential will be made with the skull for a long time and make it ideal to produce a signal large enough for the scalp to be saved. Pyramidal cell of the cortex 5. SINK: At the synaptic site of EPSP, positive ions enter the cell to store the local membrane. SOURCE: The more distal part of the cell flows through the cell, completing a passive closed circuit of current. •Primary current: Current flow within the cell (intra-cell). (MEG Production) •Secondary or rotation current: Flow outside the cell (non-cell). (EEG production) Sink Welding + + + + + + + 6. Pyramiddipol. • Because pyramidal cell PSPs form one circuit of current flow along the length of each cell, one end of the pyramidal cell has contrasting polarity from the other. • A µvolt EEG signal is recorded when a large number of pyramidal cells are synchronized and many small dipoles are combined. 7. • Basket cells, due to numerous structures/orientations, although they do not produce electrical activity that can be detected in scalp records. • However, pyramidal cells show electrical activity strong enough to be recorded by scalp electrodes due to their orientation and synchronous ignition. 8. The recording that detects the highest amplitude signal covers the electrotcortical source. 9. • The source is in a crack. • The source is primarily in a sulci. • Cortical anatomy and orientation have changed due to developmental malformation, trauma, surgery. • Skull thickness has changed (surgical disorders, thickening due to Pagets disease, etc.). Exceptions for this simple model 10. Pyramidal cell orientation Cortex 11. -µv +µv SP1 P2 + S: Voltage amplitudiity. P1, P2: Electrodes. The current from the cortical source to the electrode is equal to the area contained in the lines that begin from the cortex and merged on the electrode. The source for P2 projects both negativity from the outer cortex (the area between straight lines) and positivity from the inner cortex (the area between dashed lines). Therefore, the voltage of the signal decreases. Volume conduction theory for a cortical resource that containers an girus 12. • Scalp EEG can be imagined as an ever-changing relief map of hills and valleys with heights and depths of the map representing a certain tension. • The more electrodes are used, the more accurately they map the actual congraphs of scalp potential. 13. Differential amplifier Input terminal 1 Input terminal 2 Fp2 C4 Oz Physiological electrical currents are detected using differential amplifiers. Input 1- Input 2= Registered EEG signal (hence differential) 14. Common mode rejection • The advantage of differential amplifiers is that they cancel out external noise. • Other electrical devices are the most common source of noise. • For example, when the current is given in 50-60 cycles/s, it causes electrical interference that pollutes 1 and 2 equally. This differential is canceled by the amplifier. • Since differential amplifier is used, the absolute voltage value of electrodes connected to Input 1 or 2 is never known, only the difference between them is known. 15. Differential amplifier polarity • Current flowing through the scalp: positive or negative polarity. • Amplifier output (Input 1- Input 2) is assigned polarity (positive or negative). • Input 1 more negative input than 2: upward deviation • Input 1= Input 2: no deviation (straight line) • Input 1 Input less negative than 2: downward deviation 16. -40uV -70uV -80uV -40uV -40uV -40uV +60uV -40uV -40uV -(-70)== +30uV -80 –(-40)= -40 uV -40- (-40)= 0 +60-(-40)=+100uV +50uV +50uV +50-(+70)=-20uV 1 1 1 1 2 2 2 2 2 17. Derivatives and Assemblies. • An amplifier is a pair of electrodes: electrode derivative. For example, Fp1-F3. • If adjacent electrodes are mapned, it is called bipolar. For example, Fp1-F3 • If there is a reference electrode in the pair, it is called referential deing. For example, Fp1-A1. • A screen of derivatives is called assembly. • Accordingly, assemblies can be referenced or bipolar to visualize common vs. localized areas, respectively. • Bipolar assemblies can be longitudinal or over-the-top. 18. Assemblies 19. Spatial filtering shows the electric field of the small cortical generator of bipolar referential bipolar derivative (red). The larger generator (green) is canceled as both electrodes are placed on top of it. Reference The large area is clearly seen as an electrode outside the two areas, but the small generator area is not well made. 20. Referential Vs Bipolar (longitudinal vs. over) • Both are equally important. • Neither is superior; Spatial filters that emphasize different aspects of scalp topography of EEG voltage areas. • Longitudinal and overly bipolar assemblies are both used, because scalp tension areas can be asymmetrical along the posterior or axine axis with anterior. • To evaluate such asymmetries, we need to use both longitudinal and cross-bipolar assembly or using a bipolar and reference assembly. 21. Spatial filters: Assemblies Longitudinal bipolar assembly Cross-bipolar assembly Laplacian assembly Average reference assembly Common reference assembly Maximumfilteringofwidespreadfields Maximumenhancementofhighly high localisedfields 22. EEG scalp localization 1. Identification and classification of EEG activity is always based on localization to some degree. 2. Localization can help determine whether the origin of an activity is cerebral or a work. 3. Clinical correlation of EEG requires cortical localization of EEG findings. 4. Localization helps accurately interpret an EEG pattern that the reader has never encountered before. 23. EEG signal • Localization consists of 2 steps: 1. Localization of EEG activity to specific electrode positions on the scalp 2. The underlying cerebral cortex is related to the localization of the scalp to the possible source. 24. Localization of current fields: Bipolar assembly • Electrode with highest voltage potential: 1. Instrumental phase return. 2. Reverse the instrumental phase with the cancellation of an intervention deproductive. 3. End or phase reversal of the chain phenomenon. 4. End of chain phenomenon with cancellation. 5. Correct phase return (double phase reverse). 25. Bipolar Vs Referential • Bipolar assembly: localization is carried out by analyzing phase orientation and amplituity. • Reference assembly: localization is mainly by amplitual analysis. • The phase means that the wave form devises up or down the baseline. • If the phase has changed direction from top to bottom, phase change has occurred. 26. Instrumental phase return Fp1-F3 F3-C3 C3-P3-P3-O1 The electrode, which is common in both channels, localizes the maximum field potential of the phase for that common electrode (e.g. F3). In the next channel that causes the phase to be reconstructed, the arrangement of electrodes that become input 2 electrodes is called instrumental phase return. 27. Bipolar longitudinal assembly showing the reverse of the instrumental phase along C3, and also p3 frequently suggest that the pointed C3 and P3 area is closest to maxima. 28. Bipolar longitude showing mount Inverse of the phase along F3, F3 suggests that the area is closest to maxima. 29. Sharp waves in F3,C3, bipolar longitudinal assembly showing instrumental phase rotation throughout F3, suggest that F3 is closest to field maxima. 30. Reverse the instrumental phase with cancellation in an intervention channel. The channel that interferes with Fp1-F3 F3-C3 C3-P3-P3-O1 Cancellation (F3-C3) maximizes the space between the electrodes in that channel. 31. Bipolar longitudinal assembly showing instrumental phase reversal throughout C3, and also phase reversal with cancellation of T3-T5. 32. End of chaining. Fp1-F3 F3-C3 C3-P3 P3-O1 If the opposite phase is not seen, the field maxima is closest to the maximum amplitude electrode. It's localized to the electrode at the end of the electrode chain, and it doesn't show that the source is deep in the brain. 33. End of chain phenomenon with cancellation. Fp1-F3 F3-C3 C3-P3-P3-O1 Area maxima localization between fp1 and F3 electrodes at the end of bipolar chain. The voltage (amplitude) exchange rate between the two electrodes is usually close to the field maxima and at least the largest at a distance. The presence of a higher amplitude in Channel 2 than 3 localizes the area maxim up to the front of the head. 34. Correct phase return • This is rare and usually occurs in BCECTS or with the change of cortical anatomy. • It means that there are two different poles in the neighboring cortical areas at the same time. • Epileptic discharges occur at a parallel angle to the cortical surface (tangential dipole), which allows both negativity from the outer cortex and positivity from the deep cortex to be seen at the same time. 35. Reference assembly compatible with BCECTS (tangential dipole), showing frequent spikes with frontal positivity and negativity in the central, parietal and temporal channels. 36. Mounting the reference of a 5-year-old boy with BCETS: positivity projects anterior and negativity more posterior. Anterior positivity is lower in amplitutu deity than posterior negativity. This longitudinal bipolar chain will produce two instrumental phase reversals. 37. Common reference assembly Fp1-A1 F3-A1 C3-A1 P3-A1 Defines channel input with the highest amplitude 1 field maxima nearest electrode (F3). In this example, the reference electrode A1 is outside the scalp area. 38. Reference assembly showing frequent spikes in maximum amplitude in P3 and C3, indicating localization of field maximism to these electrodes. 39. Reference assembly showing frequent spikes with maximum amplitude in T6 and smaller amplitude in O2 and localization of field maximality to T6 electrode. Reference assembly showing generalized policing and wave discharges with maximum amplitule in 40. F3, F4, Fp1 and Fp2. 41. Generalized policing and Maximum amplitutular discharges in F3, F4, Fp1 and Fp2. Reference contamination fp1-A1 F3-A1 C3-A1 P3-A1 with common reference assembly Reference electrode A1 positive scalp area inside, while other scalp electrodes are outside. Therefore, the deviation is the same in each channel and up, because the input for each channel is 2 more negative than input 1. + 43. Common reference assembly showing similar morphology and amplitule waveforms in all channels suggesting reference contamination. Changing the reference to another location can eliminate this anomaly. 44. Reference contamination fp1-A1 F3-A1 C3-A1 P3-A1 P3-A1 with common reference assembly Reference electrode A1, Input 1 is contaminated with activity detected by electrodes. A unipolar area do not produce waveforms of the opposite phase in the reference record between adjacent channels unless the reference is contaminated. Two-phase feedback is pathoognomonic of reference electrode contamination. 45. Conclusion • EEG is a graphical representation of summated PSPs of largely cerebral cortex pyramidal neurons. • Pyramidal dipole is recorded on the scalp, especially radial dipole, but sometimes it is a tangential dipole. • Bipolar assemblies define localized areas, reference assemblies record common areas. • Surface negativity is recorded as an upward deviation in input 1. • For welding localization, bipolar assemblies use canceled or una-canceled phase return, maximum amplituity in reference assemblies. 46. THANK YOU