Quantitative Assessment of Changes in Brain Activity After a Chiropractic Adjustment

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Background / Introduction

- Despite the abundance of theories concerning the effects of chiropractic adjustment on brain function, this topic remains an understudied area of the profession.
- This may be due to the limited availability of cost effective, objective measures representing changes in brain function.
- Quantitative electroencephalography (qEEG) is a technique that allows for an in-depth analysis of brain activity, and may provide a cost-effective method for studying the effects of chiropractic intervention on the brain.
- qEEG allows for real-time analysis of brain activity which cannot be achieved with any other brain imaging technology.
- As with all source imaging methods, care must be taken to prevent distortion in and production of artifacts.
- Body movement artifacts represent one of the largest challenges to clean data.
- Many chiropractic adjustments generate enough force to disrupt the qEEG data acquisition.
- Low-frequency techniques provide intervention with minimal production of artifact.

Methods / Procedures

Schedule of events

<table>
<thead>
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<th>qEEG assessment</th>
<th>Chiropractic adjustment</th>
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<tr>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
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<tr>
<td>Day 1</td>
<td>Day 8 (1 week later)</td>
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Overall description of case study

- A 33-year-old female patient received a preliminary qEEG assessment with no intervention on 3/10/14 (Day 1).
- One week later (3/17/14, Day 8), a follow up qEEG was conducted before and after receiving a chiropractic adjustment.

qEEG methodology

- A Cadwell® EASY II system on 19-channels using the 10/20 system with a linked-ears montage was used.
- Neural function was evaluated via qEEG using Neurogauge TM.
- Surface qEEG was analyzed using raw EEG values Low Resolution Electromagnetic Tomography (LORETA) and connectivity measures were compared with a normative database.
- Eyes-closed data was collected on Day 1 and Day 8.
- Approximately 120 seconds of data was analyzed for each recording.

Chiropractic methodology

- Analysis and intervention was based on Sacro Occipital Technique (SOT)®.
- An Activator® II instrument was used for adjusting non-pelvic segments.

Findings

- Right leg short Category II
- PS occiput right
- Left sacroiliac joint involvement

Results

- First: PS occiput right with Activator® II instrument
- Supine Category II block, right leg short position

Comparison of raw qEEG values at each electrode site

A vs. B: No adjustment
- Minimal change on Day 1 vs Day 8 baseline

Areas of red indicate significant (P < 0.001) change between the 2 time points being compared

B vs. C: Adjustment given
- Widespread change on Day 8 before vs after adjustment

LORETA: Area in red is where most change was seen after adjustment

A: Before chiropractic adjustment
- BA 29, BA 39, BA 41 (submarginal gyrus, temporal lobe and inferior parietal lobule, temporal lobe)

B: Before adjustment
- BA 22, superior temporal gyrus, temporal lobe.

C: After adjustment
- BA 22, superior temporal gyrus, temporal lobe.

Discussion / Conclusion

- Three types of measures statistically significantly changed after a chiropractic adjustment, but not in a control scenario.
- Surface qEEG measures using raw values
  - Source localized measures using LORETA and a normative database
  - Connectivity measures using a normative database
- Source localization of the greatest change was on the same side of the brain as the short leg and occiput listing; left sacroiliac involvement was contralateral to said source localization.
- Connectivity measures demonstrated changes both intra- and inter-hemispherically.
- The chiropractic adjustment resulted in changes in phase lock, which is a measure of EEG synchronization. Synchronization and desynchronization in the brain is found in function and dysfunction including epilepsy, dementia, traumatic brain injury, cognitive function, working memory, sensory-motor interactions, hippocampal long term potentiation, intelligence, autism and consciousness.
- qEEG appears to be a viable method to document chiropractic effects, or absence thereof, on brain function.
- A study using a larger sample size, active, sham and control groups is currently underway: Effects of chiropractic adjustments on brain function using quantitative electroencephalography.

Connectivity significantly changed after chiropractic adjustment

A: Day 1 baseline
B: Day 8 before adjustment
C: Day 8 after adjustment

Statistically Significant Change

A vs. B: 177 measures
B vs. C: 41/177 measures

Connectivity in the delta band (1-4 Hz) was measured in phase lock duration

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Bibliography