Effect of Proprioceptive Neuromuscular Facilitation on EEG Activation Induced by Facilitating Position in Patients with Spinocerebellar Degeneration

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It is well known that reaction time (RT) of a muscle depends upon the posture. For instance, RT of the triceps brachii muscle for elbow extension is faster at facilitating position of the shoulder than at neutral position (Nakamura and Viel 1974; Nakamura 1976/77). This phenomenon is attributed to the shift of arousal level induced by the postural changes (Maria 1970, Nakamura 1983; Hosokawa et al. 1985). Previous studies showed that postural dependence of RT disappeared in patients with cerebellar lesion (Nakamura 1976/77), and reappeared transiently after proprioceptive neuromuscular facilitation (PNF) maneuver, a technique of physical therapy (Nakamura and Taniguchi 1980). The reappearance of postural dependence of RT after PNF maneuver was accompanied with the improvement of performance such as hand writing, maximum walking velocity and stability of standing balance (Nakamura and Taniguchi 1980). Moreover, long-term PNF treatment was already proved to be effective for the restoration of motor function in those patients (Sato et al. 1981). Thus, the reappearance of postural dependence of RT has been a useful indicator to select the patients for PNF treatment. However, RT study is not always applicable to the
patients due to unsteadiness of their performance. Our recent study (Hosokawa et al. 1985) suggested that the shift of arousal level due to postural changes could be detected by the measurement of mean power in alpha band of EEG. In this paper we examined the effect of postural changes on the mean power in alpha band of EEG before and after PNF maneuver in patients with spinocerebellar degeneration (SCD), and attempted to confirm the applicability of EEG topography instead of RT study.

Five patients with SCD participated in the study (Table 1). The method to analyze the shift of mean power in alpha band of EEG due to postural changes was already reported (Hosokawa et al. 1985). The patient sat on a chair with closed eyes and EEGs were recorded in two positions of the left lower extremity: neutral (N), the hip flexed at 90° and neutral rotation; and facilitating (F), the left hip being passively maintained at 30° internal rotation. The mean power in alpha band was obtained using the procedure reported by Ueno and Matsuoka (1976). Difference of the mean power between the two positions, d (F-N), was calculated by subtracting the mean power at N from that at F. The EEG recordings were performed before and after PNF maneuver lasting about 5 min.

Table 1 presents d (F-N) before and after PNF maneuver. Before PNF maneuver d (F-N) was positive in one patient and negative in two, i.e., normal EEG response to postural changes was observed in only one patient. However, after PNF maneuver d (F-N) became positive in four and still negative in one, i.e., EEG response of four out of five patients was considered to be normal. According to clinical reports from physical therapists treating the patients, PNF treatment was effective for the improvement of motor function in the patients with positive d (F-N) but not in the patient without positive d (F-N) after PNF maneuver.

These results indicate that comparison of the mean power in alpha band between N and F position after PNF maneuver is useful for the selection of patients as a candidate of PNF treatment.

**Table 1.** Demographic data of the patients and difference of the mean power (µV) in alpha band of EEG between N and F

<table>
<thead>
<tr>
<th>Clinical diagnosis</th>
<th>OPCA</th>
<th>LCCA</th>
<th>LCCA</th>
<th>OPCA</th>
<th>OPCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36</td>
<td>52</td>
<td>61</td>
<td>49</td>
<td>54</td>
</tr>
<tr>
<td>Duration of illness (years)</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Before PNF maneuver</td>
<td>-0.94</td>
<td>1.89†</td>
<td>-0.94†</td>
<td>-2.04†</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>(1.95)</td>
<td>(2.16)</td>
<td>(1.83)</td>
<td>(1.22)</td>
<td>(0.73)</td>
</tr>
<tr>
<td>After PNF maneuver</td>
<td>1.45*</td>
<td>5.39†</td>
<td>2.16†</td>
<td>2.52†</td>
<td>-1.58†</td>
</tr>
<tr>
<td></td>
<td>(2.75)</td>
<td>(2.46)</td>
<td>(1.11)</td>
<td>(1.42)</td>
<td>(1.46)</td>
</tr>
</tbody>
</table>

OPCA, olivo-ponto-cerebellar atrophy; LCCA, late cortical cerebellar atrophy; s.d. in parentheses. *p < 0.05; †p < 0.01.
Effect of PNF

References


