

## **FACIAL ELECTRONEUROGRAPHY IN BELL'S PALSY**

### **VARIABILITY IN THE EARLY STAGE AND COMPARISON BETWEEN INTERPRETATION METHODS**

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**ABSTRACT** - To determine the variability of the abnormalities found in the electroneurography (ENG) of the facial nerve in cases of Bell's palsy during the initial two week period was one of the objectives of the authors. A second one was to investigate the value of ENG as a tool to determine an early prognosis of recovery utilizing two different methods. In the first one the amplitude of the compound muscular action potential (CMAP) obtained on the paralyzed side was compared to this potential on the opposite (normal) side. The second method compared the CMAP on the paralyzed side to normal standardized data from normal individuals. A group of 33 patients with Bell's palsy was followed until total recovery or for at least 4 months, if the recovery was not achieved earlier. It was observed that amplitude of the CMAP become stable towards the sixth day of palsy and this is a good time to establish the prognosis. Another conclusion is that both methods were equivalent to determine the prognosis in Bell's palsy.

**KEY WORDS:** electroneurography, Bell's palsy, facial nerve.

**Eletroneurografia do nervo facial na paralisia de Bell: variabilidade na fase aguda e comparação entre técnicas**

**RESUMO** - O objetivo deste trabalho é determinar a variabilidade da eletroneurografia (ENG) do nervo facial na paralisia de Bell durante as primeiras duas semanas e investigar o valor da ENG na determinação de um prognóstico precoce utilizando-se dois métodos diferentes. O primeiro método compara a amplitude do potencial de ação muscular composto obtido no lado paralisado com o lado normal e o segundo método compara o potencial de ação muscular composto obtido no lado paralisado com valores normativos. Um grupo de 33 pacientes com paralisia de Bell foi seguido até a recuperação total ou pelo menos por quatro meses nos casos em que não houve recuperação. Observou-se que a amplitude do potencial de ação muscular composto estabiliza-se em torno do sexto dia e que este é um bom momento para se realizar o exame e se estabelecer um prognóstico. Outra conclusão é que ambos os métodos são equivalentes para determinação prognóstica.

**PALAVRAS-CHAVE:** eletroneurografia, paralisia de Bell, nervo facial.

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The pathologic process in idiopathic peripheral facial palsy stabilizes two weeks after the beginning of the illness<sup>3\*</sup>. The usual method of electroneurography (ENG) used to determine the prognosis in Bell's palsy consists of comparing the amplitude of the compound muscular action potential (CMAP) registered on the affected side with the CMAP amplitude obtained on the normal hemiface. A large difference implies a great number of nerve fibers affected and a worse prognosis.

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The CMAP amplitude registered on the affected side can also be compared with normative values<sup>2</sup>. This method is particularly helpful in cases with bilateral facial palsy or in those who had a previous palsy on the opposite side<sup>9</sup>.

The objectives of this work are to determine the variability of the CMAP amplitude during the first two weeks of Bell's palsy aiming to find the most adequate moment to perform the examination, and to compare the methods used in order to establish a prognosis.

## METHODS

Thirty three patients were examined, 18 women and 15 men. The age ranged between 2 and 68 years old, average 32 and median 33 years old. The requirements for patient inclusion in the present study were: 1) Bell's palsy diagnosis according to Taverner<sup>18</sup>, 2) absence of previous peripheral facial palsy, 3) continuous follow-up until complete recovery or until the fourth month of palsy if recovery was not complete.

In 18 patients from this group the ENG was done three times during the first two weeks after the beginning of the illness. The first examination occurred between the first and fifth day; the second between the sixth and tenth day and the last one between the eleventh and the fifteenth day. All patients were clinically examined at least once during the first two weeks. The prognoses given by ENG were based on two methods. For method 1 the prognosis was determined by the difference in the CMAP amplitudes recorded in both hemifaces of the same patient and for method 2 by the difference in the CMAP amplitudes recorded on the paralyzed side and the lower limit of normality determined in a group of 65 normal individuals (2,000  $\mu$ V)<sup>15</sup>. The prognosis (Table 1) was determined according to Esslen<sup>3</sup>.

An electromyography equipment ATI 900 was used. The filters were set at 25 Hz and 3 KHz and the analysis time was 20 ms. Recording electrodes were two felt pads of 6 mm diameter fixed to a bar with 2.5 cm of intercenter distance and soaked in physiological saline. The active electrode was positioned juxtaposed to the ala nasi and the reference electrode below it along the nasolabial fold. The ground electrode was fixed to the hand. The facial nerve was stimulated with the cathode just over the tragus, according to a method previously described<sup>14</sup>.

Clinical evaluation was done together with the first ENG and afterwards monthly until complete recovery or until the fourth month if recovery was not achieved. Facial symmetry was examined during rest and movement ( front contraction, closing the eyes and showing the teeth ) and a classification from 0 to 3 was given in each case. A total score of 100 was then divided between the four situations according to their contribution to the facial symmetry: rest 30, front contraction 10, closing the eyes 30, showing the teeth 30. Finally, a score was given to each degree of symmetry.

Statistical analysis: The Kappa measure of agreement was used to study the concordance between prognosis and recovery and the Friedman two way analysis of variance by ranks to compare latencies and amplitudes during the three examinations.

## RESULTS

The CMAP amplitude recorded on the affected side until the fifth day of palsy (2.1 mV) was higher than that obtained between the sixth and tenth day (1.2 mV) or those obtained between the eleventh and fifteenth day (1.0 mV)( $p < 0.05$ ). When the CMAP amplitude differences between the sixth and the tenth day and the eleventh and fifteenth day were compared no statistical difference was obtained.

Of the 33 patients examined, 23 (69.7%) recovered facial function and 10 (30.3%) presented sequels at the last examination (facial asymmetry). The CMAP amplitude recorded on the affected side is negative and significantly correlated to the number of days necessary for recovery of motor function ( $p < 0.05$ ). Both methods were similar in predicting prognosis (Table 2). All patients who had a good prognosis were normal at the end of the fourth month. The four patients that had a bad ENG prognosis showed sequels at the final clinical examination. Tables 3 and 4 demonstrate the concordance between the prognosis given by methods 1 and 2, respectively, and the clinical recovery.

*Table 1. Requirements to establish prognosis in Bell's palsy through ENG (according to Esslen<sup>4</sup>)*

| Method 1    | Method 2    | Prognosis       |
|-------------|-------------|-----------------|
| > 95%       | > 90%       | poor            |
| < 95% > 75% | < 90% > 50% | minimum sequels |
| < 75%       | < 50%       | good            |

The values in percentage correspond to the reduction of the CMAP amplitudes on method 1 when compared with the normal side and on method 2 with normative data.

*Table 2. Concordance between prognoses in 33 patients, obtained with methods 1 and 2.*

| Method 1        | Method 2       |                 |                | Total |
|-----------------|----------------|-----------------|----------------|-------|
|                 | good prognoses | minimum sequele | poor prognoses |       |
| good prognosis  | 10             | 3               | 0              | 13    |
| minimum sequele | 2              | 14              | 0              | 16    |
| poor prognoses  | 0              | 0               | 4              | 4     |
| <b>Total</b>    | 12             | 17              | 4              | 33    |

The concordant prognoses are in bold face.

Kappa measure of agreement. Weighted Kappa KW= 0.74 (p<0.001).

*Table 3. Concordance between prognoses given by method 1 and recovery in 33 patients with Bell's palsy*

| Prognosis       | Recovery |                 |      | Total |
|-----------------|----------|-----------------|------|-------|
|                 | good     | minimum sequels | poor |       |
| good            | 13       | 1               | 0    | 14    |
| minimum sequels | 11       | 4               | 0    | 15    |
| poor            | 0        | 4               | 0    | 4     |
| <b>Total</b>    | 24       | 9               | 0    | 33    |

The concordant prognoses are in bold face.

Kappa measure of agreement. Weighted Kappa KW= 0.26 (p< 0.05).

*Table 4. Concordance between prognoses given by method 2 and recovery in 33 patients with Bell's palsy*

| Prognosis       | Recovery |                 |      | Total |
|-----------------|----------|-----------------|------|-------|
|                 | good     | minimum sequels | poor |       |
| good            | 11       | 0               | 0    | 11    |
| minimum sequels | 12       | 6               | 0    | 18    |
| poor            | 0        | 4               | 0    | 4     |
| <b>Total</b>    | 23       | 10              | 0    | 33    |

The concordant prognoses are in bold face.

Kappa measure of agreement. Weighted Kappa KW= 0.29 (p< 0.005).

## DISCUSSION

Longworth and Taverner<sup>12</sup> and Taverner<sup>18</sup> emphasized the value of the CMAP latency to predict the prognosis in Bell's palsy, but Esslen<sup>3-5</sup> and Zander Olsen<sup>20,21</sup> demonstrated that the CMAP amplitude is the most important parameter. Our data corroborated this and is in accordance with previous reports<sup>2,5-7,10,11,13,16,17,19,21</sup>. However, these parameters might not be taken as absolute in predicting prognosis<sup>7</sup>. Our results suggest that the ENG is a more accurate test in cases presenting a good recovery, as we can see in Tables 3 and 4 where a higher number of disagreement occurred in cases which ENG suggested a poor prognosis and the patients had minimum sequels. Noyon<sup>16</sup> stated that "ENG is more pessimistic than the reality". On the other hand, Canter et al.<sup>1</sup> concluded that this method has a limited prognostic value in cases that have a good recovery. In our cases, comparing the method cited by Eavey et al.<sup>2</sup> (CMAP amplitude recorded on the paralyzed side compared with normative values) to the method used by Zander Olsen<sup>21</sup>, Esslen<sup>5</sup> and Fisch<sup>7</sup> (CMAP amplitude obtained in each hemiface of the patient) did not show significant differences. This fact is very important as the comparison of the CMAP amplitude obtained on the affected side to normative data is particularly helpful in cases with previous injury to the "normal" facial nerve<sup>9</sup>. According to Zander Olsen<sup>21</sup>, the CMAP amplitude difference between the normal and paralyzed sides correlates with the number of surviving motor units. Esslen<sup>5</sup> and Fisch<sup>7</sup> stated that this difference corresponds to the amount of degenerate fibers on the affected side. We must be careful to establish a linear correlation between differences of amplitudes and the proportion of degenerate fibers like Esslen<sup>5</sup> and Fisch<sup>7</sup> do because the factors that determine the CMAP amplitude are complex and difficult to be controlled by the examiner (ex. in cases where the CMAP amplitude is very reduced the masseter muscle potential may impair the registration of the facial muscle potential). Eventually we observed that some patients with Bell's palsy and a very reduced CMAP amplitude may have a fast recovery and further, it is not possible to compare the ENG with histological findings, for obvious reasons<sup>9</sup>.

As no significant difference was detected using the two methods described to establish the prognosis in Bell's palsy we may either compare the CMAP amplitude obtained on the affected side with that recorded on the normal side, or with the lower limit of the normative data, which in our series was 2,000 uV<sup>15</sup>.

Another controversy is about the ideal time to do the ENG in the acute phase of Bell's palsy and how many times the test must be repeated to establish a reliable prognosis. May et al.<sup>13</sup> recommended to do the test between the third and tenth day of palsy. Esslen<sup>5</sup> and Fisch<sup>7</sup> recommended serial examinations during the initial two weeks. Kanzaki<sup>10</sup> suggests serial examinations because he observed that some patients have a late denervation occurring around the second week. In some of our cases we found an amplitude reduction on the third day, but in most cases the reduction was detected only on the sixth day. This observation is in accordance with Kaway et al.<sup>11</sup>. In our cases after the sixth day of palsy the CMAP amplitude stabilized and did not change significantly until the fifteenth day. This fact is also reported by Gilliat and Taylor<sup>8</sup>.

We may conclude from these observations that as up to the fifth day of palsy the CMAP amplitude may continue to decrease and since between the sixth and the fifteenth day a significant variability was not observed, a single test performed in this last period is enough to establish a prognosis in Bell's palsy.

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