

## Facial Nerve Palsy Incidence, Clinical Feature, and Prognosis in AL-Madinah AL-Munawarah

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### ABSTRACT

**Background:** Bell's palsy is a commonly encountered paralysis of the facial nerve occurring worldwide. Bell's palsy prognostic value of electrophysiology and its significance in the prediction facial function outcome in facial palsy patients remains unclear. We aimed to study the electrophysiological changes occurring in the facial palsy diabetic patients.

**Methodology:** A prospective study conducted on all newly diagnosed unilateral peripheral facial palsy (PFP) in diabetic patients attended to the diabetes mellitus center outpatient clinic in king Fahad hospital in AL-Madinah, kingdom of Saudi Arabia. The health side of these patients were considered as normal control group. Each adult patient or children gradient signed an informative consent. All patients were subjected to the personal and medical history. Complete clinical, general, facial neurological examination and electrophysiological parameters of PFP, such as findings of electroneurography, blink reflex (BR), and needle electromyography (EMG). Data were collected, calculated and statistical analyses were performed by using statistical package for social sciences (SPSS version XVI, Inc., Chicago, Illinois).

**Results:** We investigated 25 Diabetic patients with unilateral facial nerve paralysis and with no history of any previous neurological disorders; age ranged from 9 to 44 years, with a mean age of  $28.44 \pm 11.99$  years, 11 (44 %) were males with a mean age of  $27.36 \pm 13.17$  years and 14 were females (56%) with a mean age of  $29.28 \pm 12.38$  years. The type I diabetes mellitus patients were 7 (28%) and type II DM were 18 (72%) with the duration was  $6.84 \pm 4.49$  years. the glucosated Hemoglobin level (HbA1C) was  $8.75 \pm 1.13$  with no significant differences in any of these previous variables.

Electromyography findings revealed that there was no statistically significant decrease in all three components latencies, amplitudes and the phases, but the follow up period recording showed highly significant decrease in amplitude and increase in latencies when compared to the early acute stage recording and the normal control group but the phases recording was not statistically significant.

**Conclusions:** Electroneurography for routine diagnostic practice, Fast, reliable, and give useful clinical information at early and late stages of the palsy as a diagnostic and prognostic tools.

**KEY WORDS:** facial nerve, bell/s palsy, Diabetes mellitus, Nerve Conduction, Electrophysiology.

### INTRODUCTION

Facial nerve paralysis is relatively rare, with an annual incidence of approximately 30 per 100,000 individuals in a population.<sup>1,2</sup> Age is a prognostic factor in patients with facial nerve paralysis. For example, age is inversely related to recovery rate<sup>3,4</sup>. Prognosis of Bell's palsy is fair with complete recovery in about 80% of the cases, 15% experience some kind of permanent nerve damage and 5% remain with severe sequelae<sup>5</sup>.

Diabetes mellitus (DM) is a major public health problem worldwide. The World Health Organization has estimated that, the number of adults with diabetes in the world would increase alarmingly from 135million in 1995 to 300 million in 2025<sup>6</sup>. One study have shown that the prevalence of DM is about (23.7%) in 2004 in Saudi Arabia<sup>7</sup> and another recent study shown that there are significant increase in the prevalence which became 30% in 2011 where was 34.1% in males and 27.6% in females<sup>8</sup>.

The prevalence of diabetes mellitus (DM) in the Saudi population is high and 90% of diabetics suffer from Type II DM. An epidemiological study of Saudi subjects aged 15 years or older, from different regions of the kingdom found that the age-adjusted prevalence of DM (using WHO criteria) was higher in urban areas (males 12%, females 14%) than rural areas (males 7%, females 7.7%). The highest prevalence was in urban females aged 51-60 years (49%). In rural areas females of similar age the prevalence was 29%. Some 56% of those found to be diabetic in this survey had no prior knowledge that they had DM.<sup>9</sup>

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Nerve conduction studies, primarily nerve conduction velocities are considered one of the most sensitive indices of the severity of neuropathy and were used to localize lesions and to describe the type and severity of the pathophysiological process, including alterations in function that are not recognized clinically<sup>10</sup> and has been used routinely to assess facial nerve functions<sup>11</sup>, also Indirect method such as the blink reflex are necessary for non invasive study of the proximal segment of the facial nerve<sup>12-14</sup>, and found to be the most useful test showing diagnostic sensitivity of 81% and specificity of 94% compared to contralateral control side, also Blink reflex proved to be prognostic value as the severity of weakness in the first week correlated positively with the outcome at 8 week<sup>15</sup>.

The aim of the present study was to study the electrophysiological changes occurring in the facial palsy diabetic patients, values in prognosis.

## METHODOLOGY

One-year descriptive prospective study with the facial palsy patients in early stage of disease (within the first ten days) attended or referred to the diabetes mellitus center outpatient clinic in king Fahad hospital in AL-Madinah AL-Munawarah in Kingdom Saudi Arabia, protocol was approved by the deanship of the scientific research, Taibah university ethical committee.

Any age of both sexes of all newly diagnosed unilateral facial palsy diabetic patients using international standard criteria.<sup>16-19</sup> were included in the study in year 2010/2011. The written informed consent was obtained from each adult patient or children gradient. This study was conducted in accordance with the Declaration of Helsinki.

The health side of these patients were considered as normal control group. We obtained detailed demographic data as age, sex, special habits, height, weight and body mass index, arterial blood pressure, glucosated haemoglobin (HbA<sub>1c</sub>), complete lipids profile, family history of hypertension, diabetes, similar condition and as well data of management, types and duration of diabetes.

The Facial palsy diagnosed by clinical criteria such as weakens of the facial muscles, inability to close eyelids, and loss of taste over the anterior 2/3 of the tongue depending on the level of lesion and numbness and loss of nerve sensation behind and around the-ear.

General examination, neurological examination of face on sides, Hearing examination, and motor examination of muscle orbicularis oculi, muscle frontalis, muscle orbicularis oris and muscle zygomaticus major. Sensory facial examination including pinprick testing, Temperature in all divisions of the trigeminal nerve, nerve intermedius behind and around the ear, and tongue taste sensation.

Complete clinical, general, facial neurological examination and electrophysiological studies including nerve conduction studies, conventional electromyographic assessment, quantitative motor unit action potential (MAUPs) analysis and Blink reflexes were obtained by applying electrical stimuli to the supraorbital nerve of one side and recording the response of both sides (ipsilateral R1 and R2 and contralateral R2) following the standard protocol<sup>20</sup>. The electrophysiological tests were performed by one neurophysiologist, and he was blinded to the clinical information of the subjects. The procedures were explained for the patient, all nerve-conduction tests performed in the same room with a comfort temperature of 22°C to 25°C using standard protocol<sup>21</sup>. The optimal recording amplifier frequency range of 50 Hz. to 10 KHz and a standard sensitivity of 100 to 500 UV by using XL Calibre Ltd EMG system used to perform the recording. The following electrophysiological procedures, elecomyographic assessment<sup>21</sup>. Quantitative MUAPs analysis was developed by Buchthal et al., 1954<sup>22, 23</sup> and modified in different studies<sup>21 & 24-27</sup>. Facial nerve conduction, and blink reflex<sup>28 & 29</sup>.

Data will be analyzed using a data entry program into a computer using statistical package for social sciences (SPSS) version 15.0, Inc., Chicago, Illinois for data entry and statistical analysis. P values were two-sided, and a P value of 0.05 or less was considered to indicate statistical significance and we will consider P value of  $\leq 0.001$  highly statistically significant.

## RESULTS

We investigated 25 Diabetic patients with unilateral facial nerve paralysis and with no history of any previous neurological disorders; age ranged from 9 to 44 years, with a mean age of  $28.44 \pm 11.99$  years, 11 (44 %) were males with a mean age of  $27.36 \pm 13.17$  years and 14 were females (56%) with a mean age of  $29.28 \pm 12.38$  years. The type I diabetes mellitus patients were 7 (28%) and type II DM were 18 (72%) with the duration was  $6.84 \pm 4.49$  years. the glucosated Hemoglobin level (HbA<sub>1c</sub>) was  $8.75 \pm 1.13$  with no significant differences in any of these previous variables.

The principle presenting symptoms of all patients were numbness around and behind the ear, pocketing the food on the affected side and inability to close the eyelids. We found that all patients with normal hearing, and facial sensation with loss of the taste sensation of the tongue anterior two third.

The electroneurography results showed that the normal group mean latency and amplitude recorded from the orbicularis oris muscle following stimulation of the facial nerve by electrical stimulation at the stylomastoid foramen (El Stim) were  $3.16 \pm 0.79$  msec with a range 1 – 5.2 msec and  $3.49 \pm 1.98$  millivolt (mv) with a range of 1.19 – 6.9 mv., The mean latency of the responses ( $4.21 \pm 0.84$  msec with ranges between 3.1 – 5.4 msec) in the acute Bell’s palsy group and in comparing both groups we found that there was statistically significant increase in latency when compared to the normal control group where p value was  $< 0.01$ , and the decrease in the mean amplitude value of the responses ( $1.51 \pm 1.05$  mv with ranges between 0.48 – 3.8 mv) in acute palsy patients group showed a statistically highly significant decrease when compared to the normal control group where p value was  $< 0.001$ .

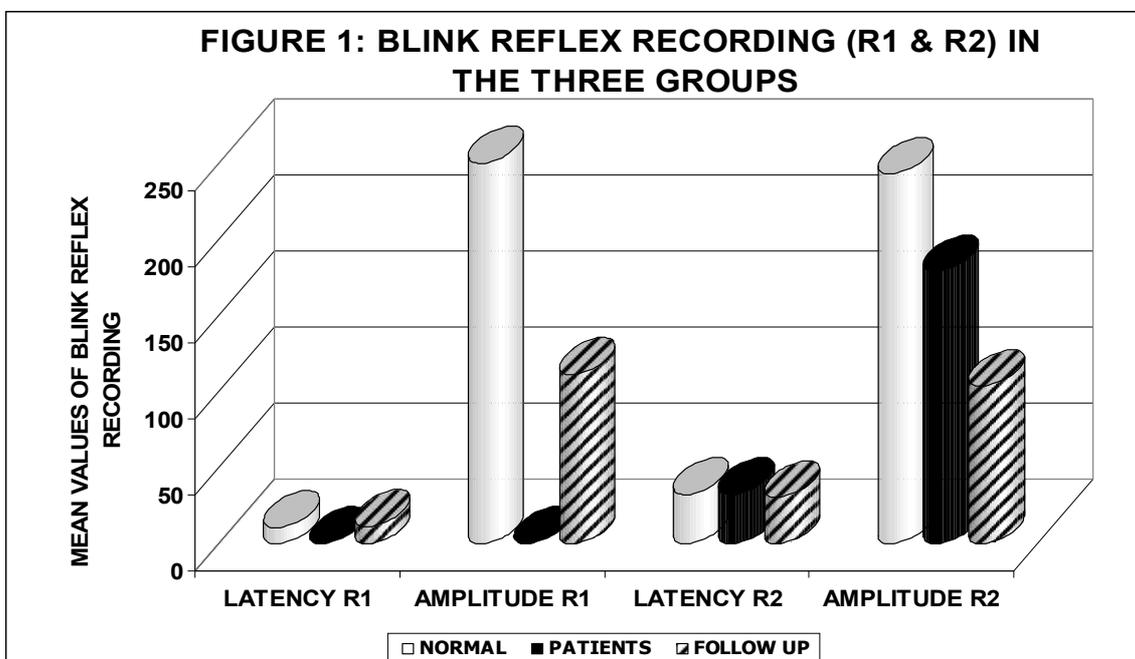
Follow up examination was carried out for acute Bell’s palsy patients after clinical improvement or one month following the initial examination. The mean latency and amplitude of the response ( $4.62 \pm 0.84$  msec and with ranges between 3.5 – 5.8 msec) and ( $0.72 \pm 0.47$  mv with ranges between 0.06 – 1.55 mv) respectively, both showed statistically significant different when compared either to the normal control group, or to the acute Bell’s palsy group (Table 1).

**Table 1: shows the latencies and amplitudes recorded mean values  $\pm$  standard deviations the stimulated the facial nerve in the three groups.**

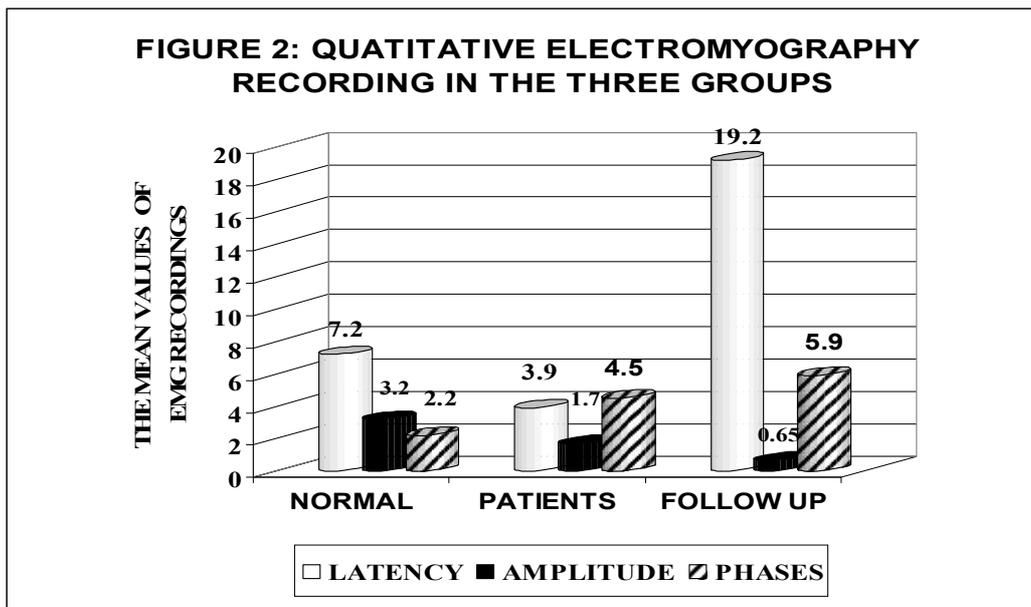
	LATENCY (MSEC.)		AMPLITUDE (MV)	
	Mean $\pm$ SD	Range	Mean $\pm$ SD	Range
<b>Control group</b>	$3.16 \pm 0.79$	1 – 5.2	$3.49 \pm 1.98$	<b>1.19 – 6.9</b>
<b>Acute patients</b>	$4.21 \pm 0.84^*$	3.1 – 5.4	$1.51 \pm 1.05^{**}$	<b>0.48 – 3.8</b>
<b>Follow up</b>	$4.62 \pm 0.84^*$	<b>3.5 – 5.8</b>	$0.72 \pm 0.47^*$	<b>0.06 – 1.55</b>

\* Statistically significant (p< 0.01) and \*\* highly statistically significant (p< 0.001)

The Blink reflex R1 component could not be recorded and the mean amplitude of the R2 component of the blink reflex in acute Bell’s palsy patients ( $178.53 \pm 150.3 \mu$  volt) showed a statistically significant decrease when compared to the normal control group ( $242.74 \pm 236.16 \mu$  volt). The mean amplitude of R1 and R2 components of the blink reflex on follow up were  $111.20 \pm 47.9 \mu$ v and  $103.53 \pm 150.03 \mu$ v with ranges of 78.85 – 238.7  $\mu$ v and 28.75 – 507.5  $\mu$ v respectively, and the R1 amplitude showed statistically significant decrease when compared with the normal control Group ( $260.97 \pm 264.02 \mu$ v) where the p value was 0.03, while the mean amplitude of R2 showed highly statistically significant difference when compared either with the normal control group or to the acute Bell’s palsy group where the p value was 0.001. (Figure 1)



Electromyography findings revealed that there was statistically significant decrease in all three components latencies, amplitudes and the phases, but the follow up period recording showed highly significant decrease in amplitude and increase in latencies when compared to the early acute stage recording and the normal control group but the phases recording was not statistically significant. (Figure 2)



### DISCUSSION

Since facial nerve is rather complex for a cranial nerve, and have a long intracranial course, in which the nerve takes three bends and pass through the narrow bony canal within the intra-temporal bone, they are more readily injured by middle ear or temporal bone surgery, trauma, infection, and compression caused by tumours in or within the vicinity of nerves<sup>30</sup>. Bell's palsy is a peripheral palsy of the facial nerve that results in muscle weakness on one side of the face and is the most common cranial neuropathy where is more common in patients with diabetes<sup>31</sup>, also tend to have a more severe paresis and evidence of substantial denervation<sup>32</sup>.

Our study has endeavoured to provide a part of the picture of the sub clinical pattern of diabetic neuropathy in DM from Saudi Arabia Kingdom as a developing area in the Middle East. Polyneuropathy prevalence varies greatly depending on the clinical and the electrophysiological diagnostic criteria of ADA<sup>18 & 19</sup>. The electrophysiological measures include the studies of sensory and motor nerve conduction. In Saudi Arabia, the prevalence of diabetic neuropathy was observed to be 35.9% after screening 1000 diabetics<sup>33</sup>.

Electrodiagnostic studies of the VII<sup>th</sup> nerve are done primarily to determine the quality and degree of axonal degeneration which can be termed denervation. Electroneurographic data (amplitude and area asymmetry) discriminate<sup>34</sup> found that electrophysiological tests like blink reflex, and peripheral nerve conduction studies were done to assess the prognostic value of these electrophysiological early in the disease. Clinical severity of weakness in the first week correlated positively with the outcome at 8 weeks.

Assessment of the functional status of the nerve is based on comparison of the amplitude of the muscle action potential from the healthy and the affected side. Mechanical tapping or electrical current delivered to the skin in the periorbital region elicits a blink reflex, which in adults consists of two distinct components: an early unilateral evoked potential (R1) followed by a late bilateral responses (R2). Both responses normally occur subsequent to ipsilateral stimulation, while only the secondary response R2 (is elicited on the contra lateral side). It was found that the early R1 response (10-12 millisecond) is mediated by an oligo-synaptic circuit as demonstrated in the cat, this early reflex is transmitted through a simple pontine arc, afferent fibers of which enter the pons through the sensory root of the trigeminal nerve<sup>35</sup>. The latency to the first reflex component (R1) may be delayed due to slowing of conduction in the facial nerve. Moreover, the reflex is absent in presence of transmission block<sup>36</sup>.

In our study, the R1 component of the blink reflex was absent in 20 out of 25 patient with recent Bell's palsy, (80 %). The mean amplitude of the R2 component was significantly lower than the mean amplitude of the normal control. On follow up examination on clinical improvement or after one month of onset of disease, the R1 component could be elicited. Therefore, the reappearance of the R1 component of the blink reflex suggests an early sign of recovery in cases of Bell's palsy which could be an important index for recovery. Our results in agreement of the finding by Kimura 2000<sup>37</sup> who reported that analysis of blink reflex provides valuable information for evaluation of the prognosis of patients with bilateral facial palsy.

Also indirect method such as the blink reflex is necessary for non invasive study of the proximal segment of the facial nerve, Kimura 2006<sup>35</sup> and 2000<sup>37</sup> found that Blink responses were the most useful test showing diagnostic sensitivity of 81% and specificity of 94% compared to contralateral control side, Hill 2001

<sup>38</sup> found also Blink reflex proved to be prognostic value as the severity of weakness in the first week correlated positively with the outcome at 8 week.

Thomander and Stalberg 1981 <sup>39</sup> compared surface area under the response curve in addition to amplitude asymmetry and found that electroneurography, combined with EMG findings reflects the degree of nerve involvement and the course of recovery. He concluded that electroneurography is well adaptable for routine diagnostic picture in facial palsy; the results are easily quantified and have sufficiently high accuracy for monitoring nerve function. Kossowski 2008 <sup>40</sup> and Chung 2011 <sup>42</sup> reported that the side-to-side amplitude comparison and electromyography are the two most valuable electrophysiologic methods of assessing facial nerve functioning.

Our conclusion parallel to the conclusions <sup>37, 43 & 44</sup> which stated that the prognosis of facial paralysis, the nerve excitability test should be used in the acute phase, and NCS and needle EMG should be used in the subacute phase. Blink reflex studies are helpful in both the acute and subacute phases and the Electroneurography is important for prognosis and considered the routine diagnostic practice, fast, reliable, and give useful clinical information at early stage of the palsy

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