

# Comparative Analysis of CMAP Amplitudes of Electro-physiologically Evaluated Facial Muscles in Facial Palsy Patients

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## Abstract

**Background:** The study describes the retrospective analysis of compound motor action potential (CMAP) amplitudes in 50 cases (25 males & 25 females) of facial nerve palsy seen in our neurophysiology Laboratory during last two years.

**Methodology:** Clinically diagnosed cases of facial nerve palsy encountered at neurophysiology laboratory went under facial nerve conduction studies. Patients evaluated for CMAPs of orbicularis oculi, Nasalis and Orbicularis oris muscles were analyzed

**Results:** Study included 50 male and female (n=25 each) patients of unilateral facial palsy with the mean age of  $33.98 \pm 14.13$  yr. CMAP amplitudes of all the three muscles on affected side were significantly (p value <0.0001) lower compared to that of normal side. CMAP amplitudes in males and females were not significantly different over both affected and normal side muscles. ANOVA of affected and normal side muscles of all the patients showed significantly (p value <0.05) different CMAP amplitudes among both affected side and normal side muscles.

**Conclusion:** It was concluded that CMAP amplitudes are significantly reduced on the affected side in facial palsy patients and they do not reflect any gender differences. CMAP amplitudes show an increasing trend from orbicularis oculi, nasalis to orbicularis oris muscle.

**Keywords:** Facial palsy, Bell's palsy, electro-physiology, Compound motor action potential (CMAP), Facial Muscles, Orbicularis oculi, Nasalis, Orbicularis oris.

## Introduction

Facial paralysis occurs as a consequence of wide array of disorders and heterogeneous etiologies, including congenital, traumatic, infectious, neoplastic, and metabolic causes<sup>1</sup>. Nerve conduction studies of facial nerve are considered as the most reliable tool for the diagnosis of facial paralysis and assess the facial nerve degeneration<sup>2,3</sup>. There is a spectrum of electrophysiological abnormalities in facial palsy cases<sup>4</sup>.

Electro-physiological studies are helpful in localizing the lesion and assessing the prognosis of recovery. CMAP of orbicularis oculi, nasalis and orbicularis oris are recorded to assess facial nerve conduction. Latency measurements of facial nerve are not as useful as the CMAP amplitude to assess the prognosis of facial nerve lesion<sup>5</sup>.

We aimed to retrospectively assess the CMAP amplitudes of electro-physiologically evaluated of facial palsy patients.

## Material and Method

The study was conducted at Gajara Raja Medical College, Gwalior, MP, India. 50 unilateral peripheral facial paralysis cases, with equal number of males (n=25) and females (n=25) were selected. Thus, total 100 facial nerves of 50 subjects were tested of which 50 nerves were on the side of facial palsy (affected side) and another 50 nerves were of normal side.

Data of CMAP amplitudes in bilateral orbicularis oculi, nasalis and orbicularis oris muscles was retrieved. CMAP amplitudes of all the subjects for each of the above muscles on affected side were grouped (affected CMAP

amplitude). Similar grouping was done on normal side (normal CMAP amplitude). The CMAP amplitudes of each of the three muscles were then compared between the above groups (affected vs. normal side comparison).

Further, in-house comparison of CMAP amplitudes among facial muscles of affected side was done. Similar comparison was done for normal side muscles.

Paired t test, unpaired t test and One-way repeated-measures ANOVA were used for statistical analysis. p value of less than 0.05 was considered statistically significant. All statistical analysis was done using Graphpad Prism 5.01 software for Windows (Graph-Pad Software, Inc., USA).

## Results

The study was conducted at Department of physiology and Department of Neurology, Gajara Raja Medical College (GRMC) and associated Jaya Arogya Hospital (JAH) Gwalior, M.P., India. This was a cross sectional retrospective study done on subjects affected with peripheral facial paralysis.

Study included 50 male and female (n=25 each) patients of facial palsy. The mean age of the patients was  $33.98 \pm 14.13$  yr. All the selected patients had unilateral facial palsy.

CMAP amplitudes of affected side were compared with that of normal side. CMAP amplitudes of all the

three muscles on affected side were significantly lower compared to normal side (Table 1, Figure 1).

CMAP amplitudes of males and females were compared for affected and normal sides respectively. No significant (p value >0.05) difference was observed between males and females for either of the above two sides (Table No. 2).

We also made an in-house comparison of the CMAP amplitudes of all three facial muscles on affected and normal sides respectively. One-way repeated-measures ANOVA followed by post hoc Bonferroni's Multiple Comparison analysis of affected side showed that CMAP amplitudes of orbicularis oculi & nsalis, orbicularis oculi & orbicularis oris and nasalis & orbicularis oris were significantly different with p values of <0.001, <0.001 and <0.05 respectively. Similarly above mentioned analysis of normal side showed that CMAP amplitudes of orbicularis oculi & nsalis, orbicularis oculi & orbicularis oris and nasalis & orbicularis oris were significantly different with p values of <0.001 for all the three measurements. Further, significantly lowest amplitude was of orbicularis oculi and the significantly highest amplitude was of the orbicularis oris muscle with the nasalis amplitude in between the two. Moreover, similar trend of observation was observed over normal side (Figure 2 and 3).

**Table No. 1 – Comparison of CMAP amplitudes of facial muscles on affected side and unaffected side in facial palsy patients (n=50)**

Muscles tested	Affected Side (n=50)	Unaffected Side (n=50)	p Value
Orbicularis Oculi (CMAP amplitude in mV)	1.374 ± 0.73	2.014 ± 0.74	< 0.0001*
Nasalis (CMAP amplitude in mV)	1.886 ± 0.94	2.83 ± 1.11	< 0.0001*
Orbicularis Oris (CMAP amplitude in mV)	2.224 ± 1.16	3.464 ± 1.37	< 0.0001*

\*p Value <0.05 was considered significant

**Table No. 2 - Comparison of CMAP amplitudes of facial muscles on affected side and unaffected side in facial palsy patients (n=50)**

Muscles tested	In the side of facial palsy (Affected side)			Normal Side (Unaffected Side)		
	Males (n = 25)	Females (n = 25)	p value	Males (n = 25)	Females (n = 25)	p value
Orbicularis Oculi (CMAP amplitude in mV)	1.52 ± 0.79	1.22 ± 0.65	>0.05	2.14 ± 0.69	1.89 ± 0.78	>0.05
Nasalis (CMAP amplitude in mV)	1.90 ± 0.90	1.87 ± 0.99	>0.05	2.90 ± 1.13	2.76 ± 1.11	>0.05
Orbicularis Oris (CMAP amplitude in mV)	2.16 ± 1.20	2.28 ± 1.14	>0.05	3.61 ± 1.28	3.32 ± 1.46	>0.05

\*p Value <0.05 was considered significant

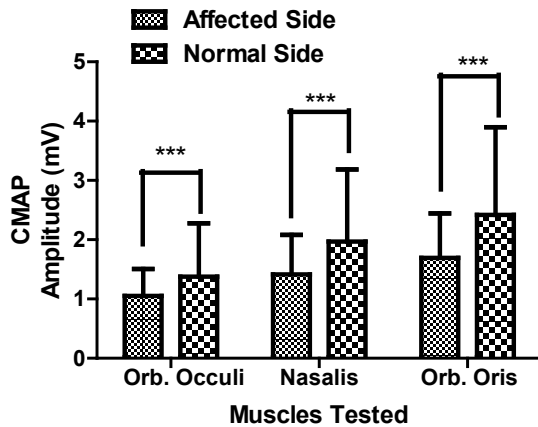


Figure 1 – Figure shows significantly higher CMAP amplitudes in normal side compared to affected side (\*represents significant difference \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.)

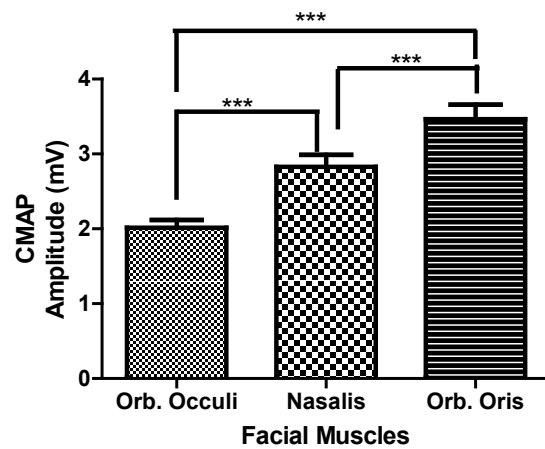


Figure 3 – Figure shows significant difference of CMAP amplitudes of the facial muscles over normal side of all the patients (\*represents significant difference \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.)

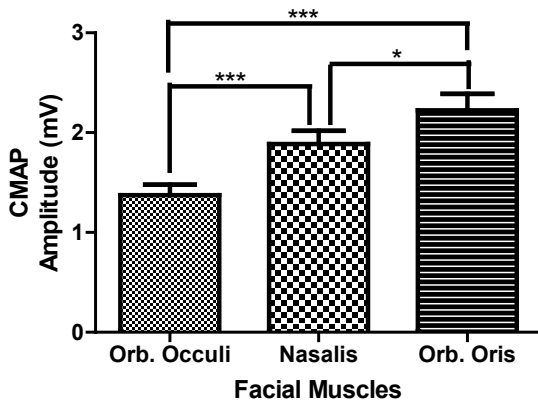


Figure 2 – Figure shows significant difference of CMAP amplitudes of the facial muscles over affected side of all the patients (\*represents significant difference \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.)

### Discussion

This study retrospectively analyzed the CMAP amplitudes of facial nerve in neurophysiologically diagnosed facial palsy patients. In this study equal number of males and female patients (total cases n=50) of facial palsy were analyzed. All the patients had unilateral facial palsy and CMAP amplitudes of orbicularis oculi, nasalis and orbicularis oris muscles were recorded on affected and normal side

We observed that CMAP amplitudes of facial nerve over all the above mentioned muscles were significantly (p value <0.0001) lower in affected side compared to normal side. Previous studies have also found that

electro-diagnosis significantly confirms the facial nerve palsy<sup>6-10</sup>.

We observed no significant difference in facial nerve CMAP amplitudes of males and females on either of the sides. No difference in normal side indicates that the strength of contraction of facial muscles is similar in males and females. Further, no difference in affected side indicates that the facial palsy similarly affects the facial nerves of males and females. However, HB Jacob (1954) found that strength of orbicularis oculi is higher in males<sup>11</sup>. The method of strength evaluation was quite different in their study and their study involved voluntary muscle contraction.

In-house comparison of the CMAP amplitudes showed significantly different CMAP amplitudes over both affected and normal sides individually. Further, amplitude order from low to high was; orbicularis oculi < nasalis < orbicularis oris. This comparison of CMAP amplitudes has not been done previously. Most of the CMAP amplitude studies either quote amplitude changes in percentage or have measured amplitude of only one muscle<sup>12-14</sup> and hence comparisons are not possible. This finding shows that in any patient if an investigator gets different amplitude order across the three muscles then it may reflect the either the abnormality of muscle or of the nerve branch supplying that muscle.

### Conclusion

We conclude that CMAP amplitudes are significantly reduced on the affected side in facial palsy patients and they do not reflect any gender differences. Increasing order of CMAP amplitudes was observed as orbicularis oculi < nasalis < orbicularis oris muscles across the facial muscles.

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**Conflict of Interest:** There is no conflict of Interest

**Ethical approval:** Study is approved by institutional Ethics Committee.

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