



Research Article

Is Palmomental Reflex Actually A Part of Feeding Behavior?

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Summary

Purpose and hypothesis: Palmomental reflex is considered to be a primitive reflex and related to pathologic processes. The reflex can be obtained from every individual by electrophysiologic measures. There have been no reports concerning submental, orbicularis oris and masseter muscle reflex responses provoked by median nerve stimulation in healthy elderly individuals and patients with dementia up to now.

Method: In the present study the median nerve was stimulated below the pain threshold and activities obtained from mental, submental, orbicularis oris and masseter muscles were recorded simultaneously in patients with dementia (n = 18) and in healthy elderly individuals (n = 18).

Result: Latencies obtained from mental, submental, orbicularis oris and masseter muscles were approximately recorded within 80 – 100 milliseconds and the differences between the latencies were not statistically significant.

Conclusion: The palmomental reflex seems to be an activity co-occurring with functions like mouth opening and swallowing, and reflecting hand – mouth reaction, rather than being only a primitive reflex involving mental muscle. We believe close temporal relationship among the activities of mental, submental, orbicularis oris and masseter muscles after hand stimulation requires these reflexes to be investigated in the physiology of hand and mouth coordination in further studies.

Key words: Palmomental reflex, perioral muscles, electromyography, feeding

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Özet

Amaç ve hipotez: Palmomental refleksi, ilkel bir refleks olarak düşünülür ve patolojik durumlarla ilişkilidir. Elektrofizyolojik olarak ise tüm bireylerden elde edilebilir. Sağlıklı yaşlılar ve demansif hastalarda, median sinir uyarımı ile submental, orbicularis oris ve masseter kaslarının refleks yanıtlarıyla ilişkili bir bildiri yapılmamıştır.

Yöntem: Bu çalışmada, demanslı hastalarda (n=18) ve sağlıklı yaşlılarda (n=18) median sinir ağrı eşiği altında uyarıldı ve mental, submental, orbicularis oris ve masseter kaslarından eş zamanlı elde edilen aktiviteler kayıtlıdır.

Bulgular: Tüm olgularda mental, submental, orbicularis oris ve masseter kaslarından elde edilen latanslar yaklaşık 80-100 milisaniye olarak saptandı ve latanslar arasında fark istatistiksel olarak anlamlı değildi.

Sonuç: Bilekte median sinir uyarımı ile tüm kaslardan benzer latanslı yanıt alınması, palmomental refleksin sadece mental kas ile ilgili ilkel bir refleks olmaktan ziyade el-ağız

ilişkinini yansıtan ve ağız açma veya yutma gibi fonksiyonlarla birlikte olan bir aktivite olduğunu göstermiştir. Bu refleksler el ve ağız koordinasyonunun fizyolojisini incelemede yeni gelişmelere yol gösterebilir.

Anahtar Kelimeler: Palmomental refleks, perioral kaslar, elektromiyografi, beslenme

INTRODUCTION

The palmomental reflex was first defined by Marinesco and Radovici. It was characterized by a unilateral or bilateral mental muscle contraction by drawing the thenar part of the hand⁽¹⁹⁾.

The palmomental reflex is quite stereotypic and the drawing of the palm of the hand always results in mental muscle contraction. Apart from this, there is no other activity observed, nor jaw movement. This reflex is not well studied, and thought as following a polysynaptic path from cervical cord to facial nucleus at the pons and is multisegmental. The afferents of the palmomental reflex are probably conducted within the median nerve and ulnar nerve. It can be hypothesized that there is an inhibition upon motor neurons of mental muscle present in facial motor nucleus via either inhibitory interneurons or by corticobulbar or limbic motor fibers directly. For this reason the reflex is generally not observed in normal individuals. However, palmomental reflex becomes apparent clinically in vascular and degenerative disorders, diffuse cortical and subcortical lesions and basal ganglia disorders that affect suprabulbar – corticobulbar fibers and thus leading to a loss of the inhibition^(1,16,23,25,29,30).

Palmomental reflex can be a rudimentary reflex that has lost its importance in humans during evolution. The primitive reflexes can be observed physiologically in newborns and the palmomental reflex may have a role during mouth opening when they hold an object with their hands. For this reason the palm is considered to an important reflexogenic area. However, this reflex can be suppressed by aging and maturation of the cortical inhibition. Though filogenetically accepted as a rudimentary reflex, palmomental reflex can

be a part of an automatic hand – mouth – jaw behavior such as eating, by investigating the muscles playing role in jaw opening.

In the present study, in order to understand the normal function of the reflex, recordings were made not only from the mental muscle, but also other trigeminofacial muscles. We aimed to understanding other components of the reflex. In this study, theoretically the neuronal connection between hand and palm innervation and perioral innervation was considered as a “feeding” reflex. Thus, the aim was evaluating whether the submental muscle group, a part of trigeminofacial muscles playing role in jaw opening, and masseter and other perioral muscles were functioning together with mental muscle or not. In this way, the hypothesis that the palmomental reflex was considered to be an initial motor behavior prior to mouth opening, chewing and swallowing could be supported.

MATERIAL AND METHODS

Cases

The cases were selected from the registered patients in DEU Faculty of Medicine Neurology Department is dementia outpatient clinic. The dementia subjects had the diagnosis of frontotemporal dementia or Alzheimer type of dementia^(18,20). These subjects did not have vascular pathology in their neuroimage studies. As for the control group, age matched healthy volunteers or patients applying to the physical therapy outpatient clinics not having a disorder interfering with the study results were selected. Both in the cases and in the control group, diabetes, alcoholism, uremia, and other metabolic, hereditary and/or degenerative disorders that could

result in peripheral nerve damage were accepted as exclusion criteria.

Eighteen patients (11 Female/ 7 Male) were included in the study and their mean age was 70.83 years (50 – 87). For the control group, 18 healthy volunteers were included (10 Female/ 8 Male), and the mean age was 65.85 ± 3.60 years (47-81). An informed consent was given to the healthy volunteers and to the legal guardians of the patients with dementia. This study was approved by the local ethics committee. There was no statistical difference between controls and dementia group regarding age.

Stimulation

The median nerve was stimulated at the level of wrist using bipolar surface electrodes (TECA accessories, MGF. No: 017C059T). Single rectangular electrical shocks were given randomly in which two successive stimuli were at least 2 seconds apart and 0,1 msec duration. The stimulus intensity was applied just below the pain threshold which was defined by control subjects and by some patients orally and from facial appearance and/or arm withdrawal in uncooperative subjects.

Recording

Superficial recordings were made by using silver chloride electrodes. Electrode couples were placed on the mentalis muscle, just 1cm lateral to the midline of the chin⁽¹¹⁾. By stimulating the median nerve, the electrode on the ipsilateral side of the mentalis muscle was accepted as an active and the contralateral one as a reference electrode. As for the submental muscle group, the active electrode was placed under the chin, 1 cm from the tip of chin and 1 cm lateral to the midline, and at the ipsilateral side of the stimulation. The reference electrode was placed symmetrically just to the contralateral side accordingly. These positions of the surface electrodes were used in investigations related to the swallowing function⁽¹³⁾. For orbicularis oris muscle, the active electrode was placed onto the margin of the mouth,

again to the ipsilateral side of the stimulation, and the reference electrode on the skin on the nose in the midline. The active electrode for masseter muscle was placed to the most prominent masseter region during teeth clenching, and its reference was placed on zygoma ipsilaterally. Electromyographic activities were recorded by Key-point Medtronic electromyographic apparatus. Electromyographic signals were filtered and amplified accordingly (10 Hz – 10 kHz). The analysis period was defined as 300 milliseconds. In order to prevent recording of some startle reactions, the first four responses were ignored. For each stimulus site, at least ten responses were recorded. All the responses were superimposed and minimal latency measures were defined accordingly. Due to the reasonable variations in the amplitudes and the durations of reflexes, amplitudes and response durations were not measured. All reflexes which were obtained during the rest and the reflex responses from four cranial muscles were recorded simultaneously.

Statistics

Means $\pm$ SD of all measured quantities was calculated and Mann Whitney U test was applied for comparison between the muscle groups. Results were considered statistically significant, if p was lower than 0,05.

RESULTS

Figure 1 shows responses obtained from mental and submental muscle groups simultaneously following stimulation of the median nerve at the level of wrist. Palmomental reflex and submental muscle group responses were obtained from all healthy volunteers and the patient group. The responses appeared approximately 80 – 90 ms later than stimulations in varying amplitudes. Response latencies of muscle groups did not differ from each other (Table 1).

In addition to mental and submental muscles, reflex responses obtained from orbicularis oris and masseter muscles were also investigated. In the control group, reflex responses were obtained in 61 % (n = 11) of the subjects from orbicularis oris muscle and in 50 % (n = 9) in the masseter muscle. Responses of these two muscles were observed at the same time with mental muscle (Figure 2). Though statistically not significant, the latencies of

orbicularis oris and masseter muscles reflex response were slightly longer and their amplitudes were smaller. In the patient group, reflex responses were obtained in 55 % (n = 10) of the cases for orbicularis oris muscle and in 44 % (n = 8) of the cases for masseter muscle. The latencies of reflex responses for these two muscles did not differ from each other significantly between the control and patient groups.

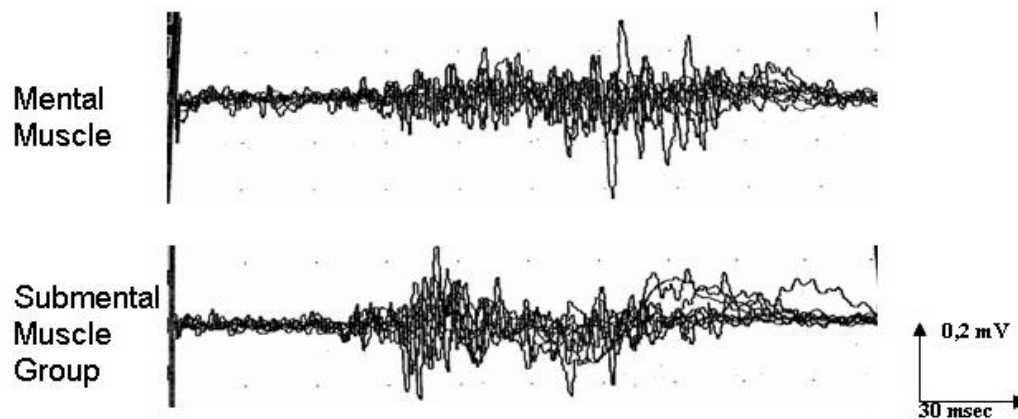


Figure 1: Mental and submental reflex responses after stimulation of the median nerve at the wrist of one normal control.

Table 1: The minimum latency durations of reflex responses obtained by stimulating the median nerve at wrist.

	Mental Muscle	Submental Muscle Complex	Orbicularis Oris Muscle	Masseter Muscle
Control group				
Mean $\pm$ SD	78 $\pm$ 13,61	84,2 $\pm$ 15,9	85,4 $\pm$ 15,5	90,0 $\pm$ 17,6
Min-max (ms)	50-100	65-120	60-110	70-120
n=18				
Patient group				
Mean $\pm$ SD	74,0 $\pm$ 19,2	81,5 $\pm$ 12,4	115,0 $\pm$ 12,2	101,6 $\pm$ 24,0
Min-max (ms)	40-105	60-100	100-130	60-120
n=18				

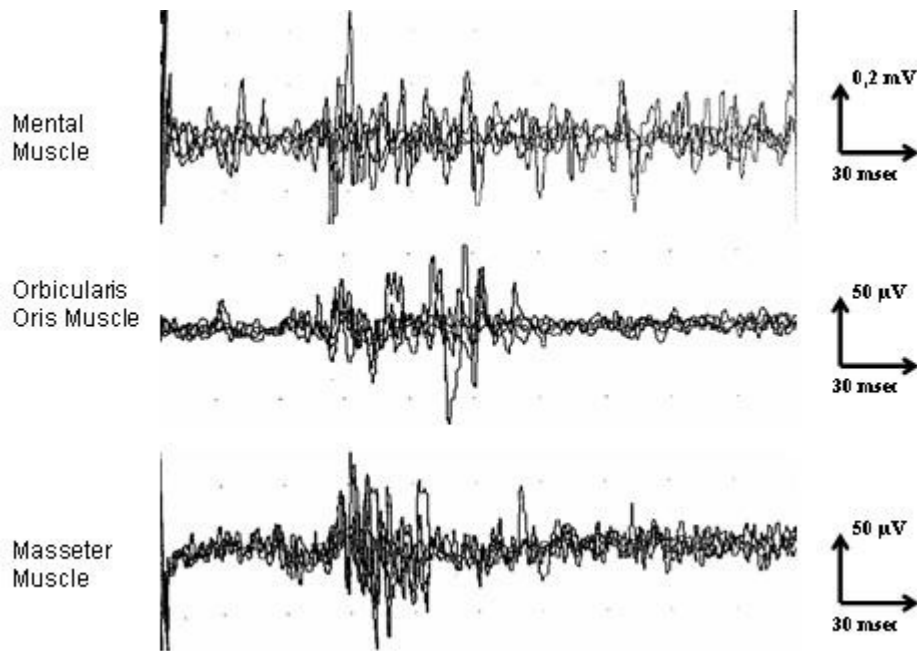


Figure 2: The superimposed reflex responses from mental, orbicularis oris and masseter muscles after stimulation of the median nerve at wrist.

DISCUSSION

Although not an important test clinically, the exaggerated form of palmomental reflex was defined as a reflex reappearing in progressive brain disorders together with primitive reflexes like sucking, grabbing and glabellar reflexes that are attributed mainly to the frontal lobe^(6,7,28). Palmomental reflex is generally tested by the observation of reflexive contraction in the mental muscle at the chin in response to drawing of the palm of the hand.

In the electromyographic studies, the palmomental reflex was only recorded from the mental muscle and the reflex was generated either by mechanical stimulation of the palm or by electrical stimulation of the median nerve at the level of wrist^(3,4,5,26). In the literature, palmomental reflex has been reported to be observed in mental muscle in all human subjects in electromyographic recordings, despite this it may not be observed in every human clinically^(1,30). In our study, the

palmomental reflex was obtained in all healthy volunteers and in all subjects in the patient group regularly and steadily as well. The novel finding in this study was the accompanying reflex responses recorded from submental muscle complex that always occurred together with the palmomental reflex by stimulating the median nerve at the wrist level. The latencies and the amplitudes of the submental muscle group reflex responses were similar to those obtained from mental muscle. Both the mental and the submental muscles were stimulated together and habituated.

The superficial recordings of the submental muscle may have arisen from the many muscles located in the anterior neck region including submental muscle up to suprahyoid muscle. These include stylohyoid, posterior digastric and may be platysma muscles innervated by facial nerves; mylohyoid and anterior digastric muscles innervated by trigeminal nerve;

genioglossus, thyrohyoid and even all muscles of the tongue innervated by hypoglossal nerve^(2,13,17,24). Thus, the responses obtained from submental region actually reflect a total activity of these muscles. Submental and suprahyoid muscles and the muscles of the pharynx and the larynx generally innervated by the vagus nerve which plays a crucial role in the dynamics of the mouth and the jaw. These muscles play a role in chewing, swallowing, breathing and speaking functions either directly or indirectly^(2,8,12,14,17,24,27) and are especially important in oropharyngeal swallowing and in initiation of the swallowing reflex. Particularly, the activity of mylohyoid muscle group is generally accepted as beginning of oropharyngeal swallowing^(9,10,12,13). In addition, electromyographic studies have showed the mental muscle to play a role in swallowing and breathing^(11,15,21,22). For this reason, the palmomental reflex and accompanying submental muscle group responses were considered possibly to be involved in some interactions between hand and mouth. In our study, after the stimulation of the median nerve, responses were obtained in two other muscles (orbicularis oris and masseter) present around the mouth and mandibula and play role in chewing and feeding behaviors; however these responses did not show continuity as in palmomental reflex and submental responses. We think that evolutionary process may be divergent in every human being resulting in the absence of some responses.

In a complex reflex behavior, the interaction between the hand and the mouth has been considered in the concept of grabbing, bringing the nutrient to the mouth and feeding behaviors of the mouth. Thus, after the tactile and the proprioceptive stimulation of the hand, mental and submental muscles could be expected to have motor contribution to jaw opening and swallowing with the

interaction of other muscles present around the mouth.

To conclude, the palmomental reflex is not an isolated, primitive reflex and is related to submental muscle complexes and other perioral muscles. Thus, this may indicate that palmomental reflex is related to a feeding behavior at a reflexive level and is under the suprasegmental control, and basically appears during the interaction between the hand and the mouth. These reflexes could be a guide in future investigations studying the physiology of hand and mouth coordination.

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Received by: 22 April 2009

Revised by: 12 June 2009

Accepted: 12 June 2009

The Online Journal of Neurological Sciences (Turkish) 1984-2009

This e-journal is run by Ege University
Faculty of Medicine,
Dept. of Neurological Surgery, Bornova,
Izmir-35100TR

as part of the Ege Neurological Surgery
World Wide Web service.

Comments and feedback:

E-mail: editor@jns.dergisi.org

URL: <http://www.jns.dergisi.org>

Journal of Neurological Sciences (Turkish)

Abbr: J. Neurol. Sci.[Turk]

ISSNe 1302-1664

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