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MILAN GREGORIĆ

NEUROPHYSIOLOGICAL ANALYSIS OF THE BLINK REFLEX IN PARKINSONISM

Electromyographic studies of blink reflex elicited by taps to periorbital region have shown that it consists of two components: of an early response which is rather constant, and of later response with highly variable parameters. Both components can also be observed on electrical stimulation of the supraorbital nerve. In normal subjects, rhythmic stimulation results in rapid habituation of the second component. On tapping the glabella, reflex blinking normaly stops after first few taps. In contrast to this, some Parkinsonian patients continue to blink on every tap for an indefinite period of time. This sign has been used by some neurologists as an early indication of Parkinsonism. Rushworth on the basis of his EMG studies decided that this was due to the persistence of the second component, which did not habituate at all (10). In contrast to this opinion is the observation by Struppler and Dobbelstein that the second component habituates in the usual way (13). These two authors thought that the persistence of blinking was due to an abnormal increase in the first component.

In our own studies, the starting points of which were the works by Rushworth, Struppler, and others, we tried to analyse the neurophysiological parameters and habituation of the blink reflex in patients with extrapyramidal syndromes and in healthy people. The blink reflex was repetitively elicited by mechanical and electrical stimuli to observe the changes developing with repetition.

MATERIALS AND METHODS

For mechanical stimulation we used an electrodynamic hammer delivering taps to the glabella at a constant strength and a repetition rate of one per second.

Electrical stimulation was performed through bipolar stimulating electrodes affixed to the skin over the right eye. The stimulus was a two milliseconds lasting train of pulses and was repeated at a rate of one per second as well.

The intensity of both stimuli was individually adjusted so that the minimal intensity to give a detectable motor response was increased by 50 per cent.

The EMG responses were detected by a pair of surface electrodes placed on the lower margin of the right orbit. After suitable amplification they were rectified and integrated by an originally constructed hybrid unit (14) connected to an averaging computer. The results were displayed and printed out in the form of sequential histograms of magnitudes of individual EMG responses.

An accelerometer was affixed to the skin over the upper part of the orbicularis oculi muscle to record mechanical movements.

The study included 10 normal subjects, 9 Parkinsonian patients, 2 patients with Huntington's chorea and one patient with dystonia musculorum deformans.

All the Parkinsonian patients exhibited marked immobility of facial muscles and a reduction in spontaneous blinking.

RESULTS

In the control group of normal subjects the blink reflex behaved in the manner described by Kugelberg, Rushworth and others. Repetitive stimulation had little effect on the first component and its temporal parameters, although the magnitude was somewhat variable. The longer lasting second component, however, underwent rapid habituation. In 8 subjects it disappeared altogether after the third tap. In only 2 subjects the initial rapid decrease was followed by occasional appearing till the end of the series. Visible blinking was correlated to the second component and disappeared together with its cessation, in spite of the persistence of the first component (fig. 1 and 2).

In contrast to the results in the normal subjects, in four out of our 9 Parkinsonian patients the first component was extremely increased in duration, while other parameters remained unchanged.

In 5 patients habituation of the second component was wery slow or was not manifested at all.

It was only in two patients that the first component was of normal duration and the second component showed rapid habituation.

In other words, there were three types of behavior of the repetetively induced blink reflex in the Parkinsonian patients.

One was characterized by an extremely prolonged first component and normally habituating second component (Fig. 3 and 4).

The second type showed a moderately prolonged or normal first component and an incompletely habituating second component. In this case the blinking persisted as a result of both components, or predominantly of the second component (Fig. 5 and 6).

The third type with its short first component and rapidly habituating second component did not differ from the normal condition. Here the blinking disappeared together with the second component.

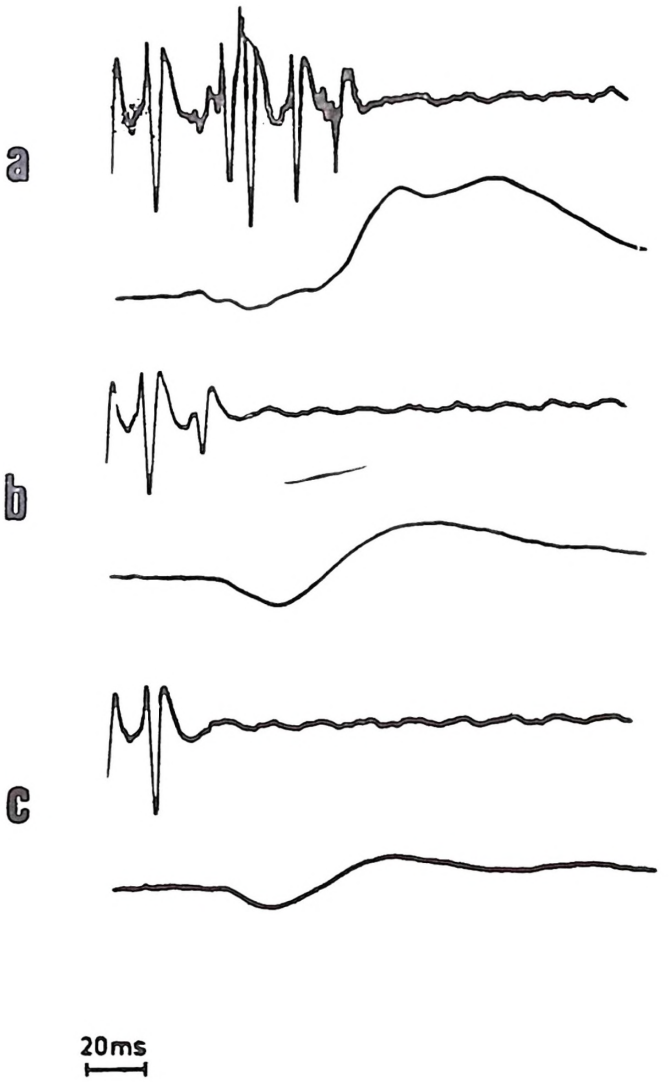

Fig. 1

The blink reflex of a normal person elicited by taps to the glabella. The upper traces are the EMG, and the lower traces are mechanical recordings by an accelerometer. The first three responses (a, b, and c) in a series are shown. Note the rapid habituation of the second component followed by virtually complete disappearence of blinking, even thought the first component persists. Calibration in the lower traces is here 10 msec.

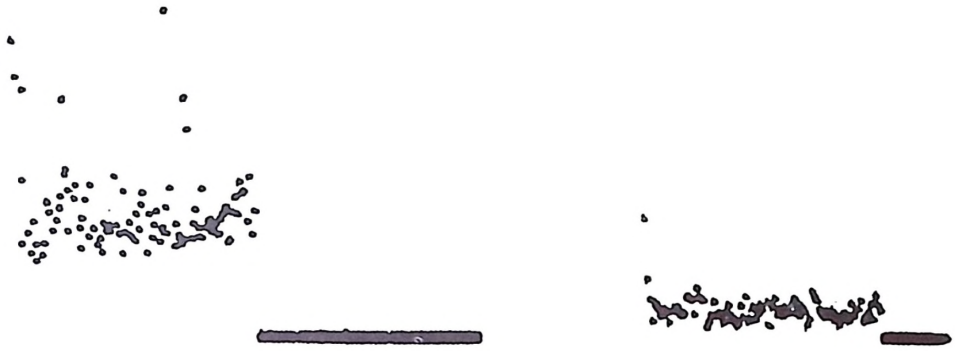

Fig. 2
A sequential histogram of a series of reflexes in a normal subject showing changes in the size of the first component (left) and rapid decrease of the second component (right).

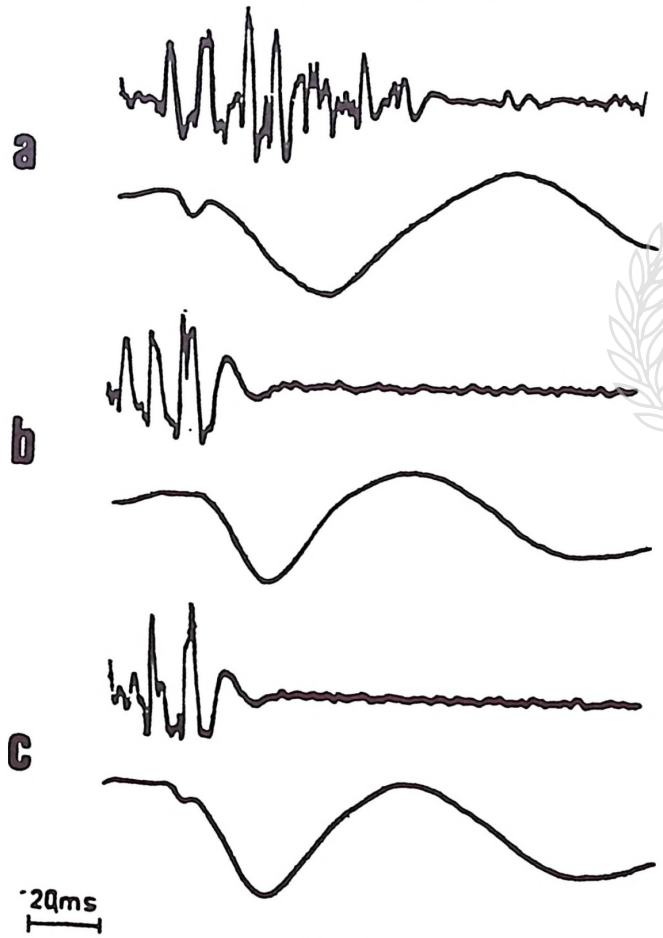

Fig. 3
The persistence of blinking due to an abnormally prolonged first component. The second component habituates normally. The first three responses of a series (a, b, and c).

Fig. 4

A sequential histogram of EMG in a series of reflexes of the type shown in Fig. 3. The first component is shown on the left, and the second on the right side.

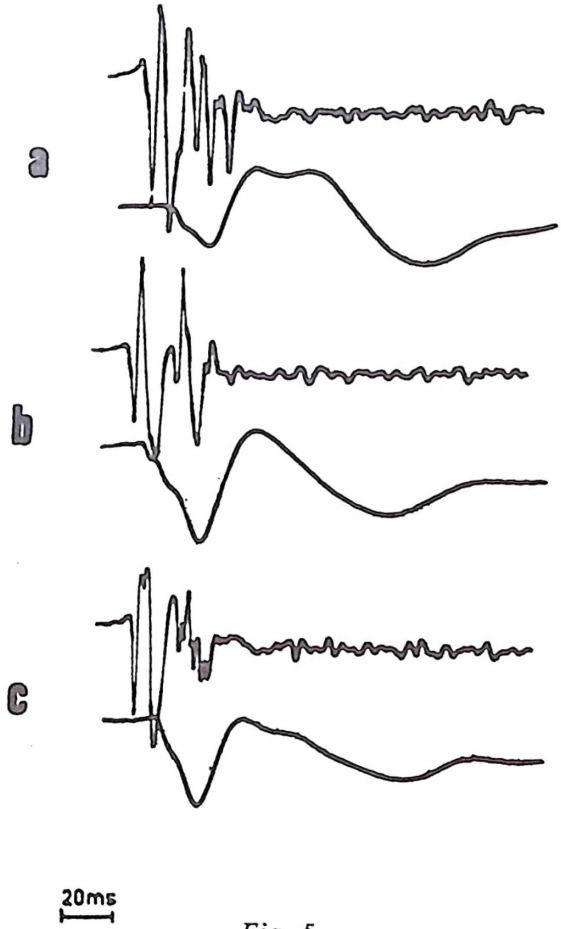

Fig. 5

The first three responses (a, b, and c) of a series of reflexes. The persistence of mechanical contractions is due to a moderate increase in the first component as well as to the slowly habituating second component.

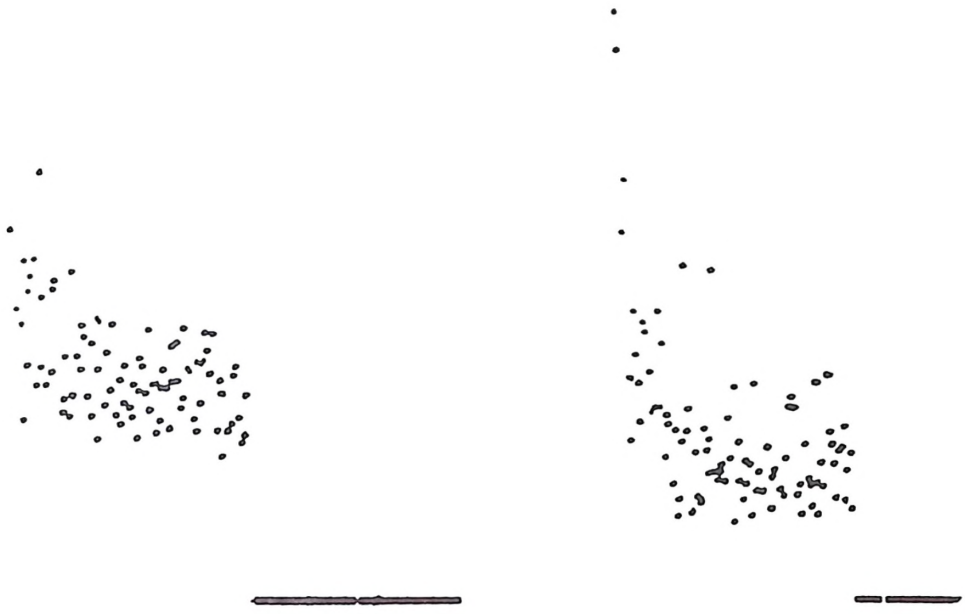

Fig. 6

A sequential histogram of the first (left) and second (right) EMG components of a series of reflexes of the type shown in Fig. 5. The second component habituates incompletely.

In one of the two patients with Huntington's chorea the first component was slightly prolonged, but the second component habituated normally in both patients (Fig. 7). This is in contrast to the findings by Struppler who reported a decrease in both components, but particularly in the second (12).

In only one patient with Dystonia musculorum deformans no abnormalities could be observed either in the parameters of the first or in habituation of the second component.

DISCUSSION AND CONCLUSIONS

The nature of the first component of the blink reflex is still a matter of controversy. Most authors consider it a proprioceptive or myotatic reflex, but others object emphasizing the lack of physiological and anatomical evidence for this explanation. According to Shahani this component may represent a highly organized cutaneous reflex (12). At the present stage of knowledge, it is not easy to decide which of the two hypothesis may be correct or more correct. It would be even more difficult to explain why the first component becomes prolonged in some Parkinsonian patients. Also, it is not known, whether or not this prolongation may be regarded a specific feature of Parkinsonism.

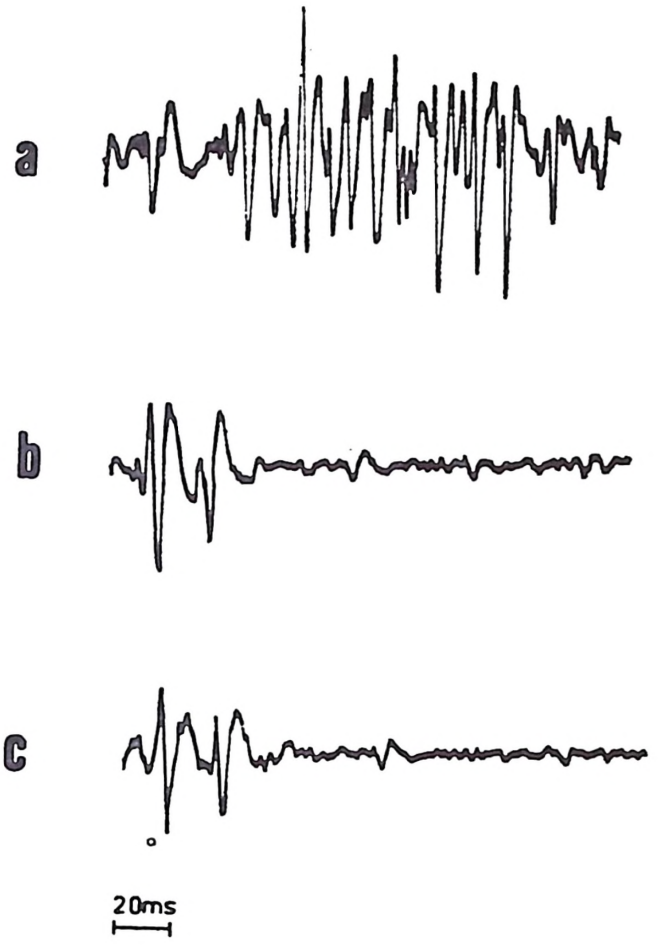

Fig. 7

The first three EMG responses of a series of blink reflexes in a patient with Huntington's chorea. The first component is slightly prolonged, while the second component habituates normally.

As to the second component, it is generally accepted to represent a kind of a defense reaction to the noxious stimulus. According to Larsson and other authors it is strongly influenced by various psychic factors (8). We have already seen that its habituation may run very different courses in different people even in the normal condition (3). It is probable, therefore, that the persistence of the glabellar reflex is a nonspecific sign, when it is a result of insufficient habituation of the second component. Pearce and associates found abnormal persistence of the glabellar reflex not only in Parkinsonism but also in certain other conditions, particularly in dementia due to large and diffuse cerebral damage (9). Klawans and Goodwin reported that in such patients the treat-

ment with L-DOPA does not abolish the persistence of the glabellar reflex, which is in contradistinction to the Parkinsonian patients (5).

Even clinical studies alone gave rise to suspicion that the mechanism of persistence may be different in the two conditions.

Our own results however indicate two different mechanisms in Parkinsonian patients themselves, one being the abnormally prolonged first component and the other insufficient habituation of the second component.

It might be interesting to look whether or not these two mechanisms are correlated with any of the aetiological or symptomatic factors of extrapyramidal disorders.

MILAN GREGORIĆ

NEUROFIZIOLOŠKA ANALIZA REFLEKSA TREPTANJA KOD PARKINSONIZMA

KRATAK SADRŽAJ

Proučavali smo elektromiografske parametre prve i druge komponente refleksa treptanja kod bolesnika s Parkinsonovim sindromom i kod kontrolne grupe zdravih ljudi. Upotrebljavali smo dva načina stimulacije: regularno ponavljanje električne i mehaničke nadražaje. Prilikom ponavljanja udaraca na glabelu refleksno treptanje kod zdravih ljudi brzo prestaje. Analiza kvantitativnih promena druge EMG-komponente pokazala je kod zdravih ljudi brzo smanjivanje odgovora; osobito kod mehaničke stimulacije — razvijala se habituacija refleksnih odgovora. Kod nekih bolesnika s Parkinsonovim sindromom treptanje prilikom udaraca na glabelu ne prestaje neodređeni period vremena. Kod nekih bolesnika sa tim fenomenom elektromiografska analiza refleksa pokazala je uvećanu prvu komponentu refleksa, uz normalnu habituaciju druge komponente. Kod druge, manje grupe, prva komponenta bila je normalna ili tek malo produžena, dok je habituacija druge komponente prilikom električne i mehaničke stimulacije bila odsutna ili jako usporena. Kod treće grupe bolesnika parametri prve EMG-komponente bili su normalni, a druga komponenta pokazala je normalnu habituaciju, iako je i kod tih bolesnika facijalna muskulatura bila zahvaćena u vidu hipomimije.

Na osnovu naših rezultata zaključujemo da je moguće razlikovati dva mehanizma perzistentnog glabelarnog refleksa kod bolesnika sa Parkinsonovim sindromom: jedan je uvećanje prve komponente refleksa, što i pored normalne habituacije druge komponente dovodi do stalnog refleksnog treptanja, a drugi mehanizam je odsutna ili usporena habituacija druge komponente refleksa.

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DISCUSSION

Kendel: Where have you fixed your accelerometer and what is the weigth of this transducer?

Gregorič: We affixed an accelerometer above the eye over the orbicularis oculi muscle. We used mechanical recording only to show that the reflex blinking on tapping the glabella in some Parkinsonian patients really persists. We did not analyse mechanical recording, only the EMG. The instrument weighs about 2 gm.