

Schirmer Test in Parkinson's Disease

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We carried out the Schirmer test to measure objectively the amount of lacrimation among 51 clinically diagnosed parkinsonian patients(33 men and 18 women aged 50 to 79 years, mean 64) and 75 age-matched controls(42 men and 33 women aged 50 to 76, mean 62). Whatman No.2 paper, prepared in precut strips 5mm by 35mm, was placed in the cul-de-sac for five minutes, after which the wetted length of the strip was studied. It was noted that the lacrimation amount decreased in patients with Parkinson's disease compared with controls : the average amount of lacrimation was 3.4 ± 2.3 mm in the former group and 8.1 ± 6.5 mm in the latter group ($p < 0.01$). We believe that the decrease in the amount of lacrimation is associated with emotional disturbance and autonomic dysfunction, and presume that the lacrimation may be under the control of the basal ganglia which has a connection with the superior salivatory nucleus downward and the limbic system upward.

Key Words : *Parkinson's disease, Lacrimation, Schirmer test.*

INTRODUCTION

The English physician and geologist James Parkinson provided the first clear description of the disorder that now bears his name in a brief monography *An Essay on the Shaking Palsy* published in 1817. Parkinson relied entirely on inspection and observation over time. Muscle tone was not assessed, and thus Parkinson did not recognize the muscular rigidity and his analysis focused particularly on the tremor (Duvoisin, 1992).

Parkinson's disease is a distinct clinical and neuropathologic entity, characterized clinically by bradykinesia, resting tremor, cogwheel rigidity, and

postural reflex impairment, and pathologically by the loss of pigmented neurons, most prominently in the substantia nigra, with associated characteristic eosinophilic cytoplasmic inclusions (Lewy bodies). This definition excludes all parkinsonism of known etiology and any disorder with multiple system involvement or significant lesions of the striatum, such as progressive supranuclear palsy, olivopontocerebellar atrophy, Shy-Drager syndrome, multiple system atrophy, or striatonigral degeneration (Tanner, 1992).

In addition to the four cardinal signs (tremor, bradykinesia, rigidity, and postural instability), there are many motor and nonmotor manifestations of Parkinson's disease, including cognitive, sensory, and autonomic disturbances (Stacy and Jankovic, 1992). It has been observed that parkinsonian patients with marked expression difficulty produce a lesser amount of tears even when crying or laughing. In spite of its lack of a real scientific basis, the Schirmer test remains the most commonly performed clinical test for sicca. We compared lacrima-

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tion amounts between patients with Parkinson's disease and age-matched controls to observe the lacrimation amount in Parkinson's disease as a preliminary study.

SUBJECTS AND METHODS

Patients

Fifty one idiopathic parkinsonian patients, aged over 50, were included in this study. They were diagnosed at the Neurologic Department of Hanyang University Hospital, and had no intrinsic ocular problem or medical illness inducing autonomic dysfunction. The mean age of the patients was 64 years with a range from 50 to 79 years. Of the 51 patients diagnosed, 33 were male and 18 were female (M : F=1 : 1.8). Anticholinergic medications (trihexyphenidyl hydrochloride, amitriptyline, etc.) and antiparkinsonian medications (L-dopa, bromocriptine, etc.) were stopped at least for 7 days (Table 1).

Controls

Seventy five age-matched persons, who visited the Ophthalmologic Outpatient Clinic at Hanyang University Hospital and had neither sicca syndrome nor irritating ophthalmic problems, were evaluated as controls. The mean age was 62 years with a range from 50 to 76 years. Forty two of these

persons were male and 33 were female (M : F=1 : 1.3).

Schirmer Test

Whatman No.2 paper was prepared in precut strips 5mm by 35mm. The strip was bent about 5mm at the end of one side and the 5mm end was inserted into the lower fornix without using any surface anesthesia. The 30mm segment was left to hang over the lower lid with both eyes closed. In 5 minutes, the strip was removed and the wetted length was measured. The test was performed once in both eyes simultaneously at controlled room condition (room temperature 18-22°C, illumination 200 lux) and mean of these values was obtained as a result. We compared the results of the Schirmer tests between the patients with Parkinson's disease and the age-matched controls.

RESULTS

In the parkinsonian group, wetted length of the Whatman No.2 paper prepared in precut 5mm by 35mm was 0-8mm (average, 3.4 ± 2.3 mm), and in age-matched controls, wetted length was 0-28mm (average, 8.1 ± 6.5 mm). The lacrimation amount decreased significantly in idiopathic parkinsonian patients compared to the age-matched controls ($p < 0.01$) (Table 2).

Table 1. Selection Criteria

Idiopathic parkinsonism	
Diagnostic criteria (Koller, 1992)	
1) the presence for at least 1 year of two of the following three cardinal motor signs	
① resting/postural tremor, ② bradykinesia, ③ rigidity	
2) responsiveness to levodopa therapy	
Aged over 50 years	
No intrinsic ocular problem	
No medical illness inducing autonomic dysfunction	
No anticholinergic and antiparkinsonian medications at least for 7 days	

Table 2. Comparison between parkinsonian patients and age-matched controls

	Parkinsonian patients	Age-matched controls
Number of patients	51	75
Sex ratio (M : F)	1.8 : 1.0	1.3 : 1.0
Mean age	64	62
Schirmer test (mean)*	3.4 ± 2.3 mm	8.1 ± 6.5 mm

* $p < 0.01$

DISCUSSION

Despite its notorious variability, the Schirmer test remains the most commonly performed clinical test for sicca. Historically, a wide variety of paper types have been used for the Schirmer test, such as filter paper, litmus paper, cigarette paper, and blotting paper. In 1961, Halberg and Berens described their standardized Schirmer paper strip manufactured from No.589 Black Ribbon filter paper (similar to Whatman No.41 paper) and prepared in pre-cut strips, 5 by 35mm. In this study, we used Whatman No.2 paper prepared in pre-cut strips 5 by 35mm as a Schirmer paper strip. Although several normal values have been cited in the literature, most people use van Bijsterveld's value of 5.0mm of wetting in 5minutes (Smolin and Thoft, 1987).

Various manifestations of autonomic dysfunction and affective disorder occur frequently among patients suffering from Parkinson's disease. The occurrence of autonomic dysfunction in parkinsonian syndrome is widely quoted. The abnormalities attributed to autonomic disturbance in this disease

include sialorrhea, seborrhea, excessive sweating, constipation, sphincter disturbances, dysphagia, postural hypotension, blue mottled skin, temperature dysregulation, impotence and disorders of pupil reactivity (Appenzeller et al., 1971; Bannister and Oppenheimer, 1972; Goetz et al., 1986). The fact that Lewy bodies exist at sympathetic and parasympathetic ganglia as well as substantia nigra elucidates the autonomic dysfunction in parkinsonian syndrome (Bethlem et al., 1960; Appenzeller and Goss, 1986). The preganglionic parasympathetic neuron for lacrimation is derived from the superior salivatory nucleus as a component of the intermediate nerve. It forms the pterygopalatine ganglion near the external genu of the facial nerve and the postganglionic neuron derives from that ganglion via the major superficial petrosal nerve and innervates the lacrimal glands. The superior salivatory nucleus receives descending autonomic fiber from the hypothalamus regulated by the limbic system (Carpenter and Sutin, 1983). The ventral striatum is also related to the limbic function (Kandel et al., 1991) (Fig. 1).

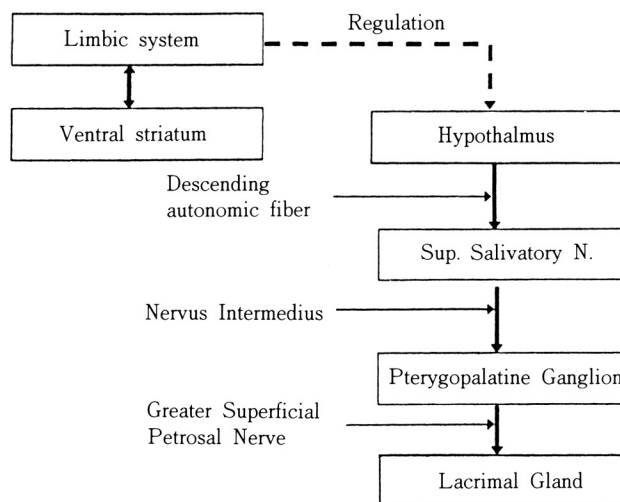


Fig. 1. Anatomy of lacrimation.

The preganglionic parasympathetic neuron is derived from the superior salivatory nucleus as a component of the intermediate nerve. It forms the pterygopalatine ganglion near the external genu of the facial nerve. The postganglionic neuron derives from that ganglion via the major superficial petrosal nerve and innervates the lacrimal glands. The superior salivatory nucleus receives descending autonomic fiber from the hypothalamus and the hypothalamus is regulated by the limbic system (Carpenter and Sutin, 1983). The ventral striatum is also related to the limbic function (Kandel et al., 1991).

Changes in the emotional state of patients with Parkinson's disease are so frequent that they are universally accepted by most clinicians. Naturally, it might be assumed that depression would occur frequently in a patient suffering from a chronic disabling disease. In fact, several studies indicate that depression is more likely to be seen in parkinsonian patients than in other equally disabled individuals (Warbuton, 1967; Horn, 1974; Robins, 1976). Nearly half of the patients with parkinsonian disease are depressed (Mayeux et al., 1981; Gotham et al., 1986).

The cerebral structures and pathways subserving emotional tearing can be defined in general terms. They include cortical, limbic, and hypothalamic systems that discharge through the descending hypothalamotegmental pathway to the parasympathetic lacrimal nuclei of the pons (Miller, 1985). In our study, the lacrimation amount in patients with Parkinson's disease was less than that in age-matched controls. We believe that this difference in lacrimation amount is a manifestation of the autonomic dysfunction in Parkinson's disease, and it is associated with the dysfunction of the basal ganglia which exists in Parkinson's disease. It may be also associated with emotional disturbance which is a limbic dysfunction. We presume that lacrimation may be under the control of the basal ganglia which has a connection with the superior salivatory nucleus downward and the limbic system upward.

In this study, we compared the difference in lacrimation amount between patients with Parkinson's disease and age-matched controls to observe the lacrimation amount in Parkinson's disease as a preliminary study. However, relationship between lacrimation amount and severity of Parkinson's disease or autonomic dysfunction was not elucidated. Further studies may make these relationships clear.

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