Dry Eye Syndrome in Subjects With Diabetes and Association With Neuropathy

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Diabetes mellitus has been identified as a risk factor for dry eye syndrome (DES). The prevalence of DES in diabetes has been reported to be up to 54.3% (1). DES compromises quality of life because it induces ocular discomfort and visual disturbance and may be complicated by corneal epithelial defects, erosions, or ulcers. Therefore, it is recognized as a growing public health problem that should be diagnosed and treated (1).

Among the various forms of diabetic neuropathies, chronic sensorimotor distal symmetric polyneuropathy (PN) is the most common form and may manifest with symptoms while sensory and motor deficits are detected (2). The cornea is one of the most densely innervated parts of the human body containing myelinated A-δ and unmyelinated C fibers, deriving its innervation from the ophthalmic division of the trigeminal nerve. Recent data suggested that patients with PN have corneal nerve fiber damage and reduced corneal sensitivity (3). According to the International Dry Eye WorkShop (DEWS), the reduced corneal sensitivity favors the occurrence of DES in two ways: first by decreasing the reflex-induced lacrimal secretion and second by reducing the blink rate and increasing evaporative tear loss (4). Although PN and DES are common in diabetes, the relationship between them is not known. The research hypothesis we tested herein was that subjects with PN may more often have DES as a result of reduced corneal sensitivity and impaired balance of tear production/evaporation.

A total of 61 subjects with type 2 diabetes and 38 control subjects were recruited in this cross-sectional study. PN was assessed by using the neuropathy disability and neuropathy symptom scores (5). We used the DEWS recommendation to assess DES (4). Moreover, the Schirmer I test, tear film breakup time (TBUT) and corneal sensitivity were evaluated (3). Subjects who wore contact lenses, had ocular/glaucoma drops, were on antihistamine or antidepressant medications, or underwent ocular surgery were excluded.

PN was diagnosed in 34 patients (55.7%). DES was diagnosed more often in subjects with PN than in those without PN and control subjects (76.5, 44.4, and 28.9%, respectively; $P < 0.001$). The values of the Schirmer I test, TBUT, and corneal sensitivity were worse in patients with PN than in those without PN and control subjects ($P < 0.001$). There were significant correlations ($P < 0.05$) between neuropathy disability, Schirmer I test, TBUT, and corneal sensitivity (Table 1).

Limitations of the study are *1*) the small number of participants; *2*) its cross-sectional design; *3*) only patients with type 2 diabetes were included; and *4*) the function of the corneal nerve plexus but not the anatomical corneal innervation and the blink rate was evaluated.

In conclusion, we have shown that DES is particularly common in patients with type 2 diabetes who have PN, and it is associated with reduced corneal sensitivity. Corneal hypoesthesia reduces patient's symptoms, and DES might be asymptomatic and insidious. We suggest that patients with PN be screened for DES and probably treated long-term for the prevention of ocular surface damage.

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Table 1—Ocular findings in control subjects and in subjects with diabetes according to the presence (PN+) or absence (PN−) of diabetic PN

	Control subjects (n = 38)	PN− (n = 27)	PN+ (n = 34)	P
Ocular surface dryness (DEWS criteria)	11 (28.9)	12 (44.4)	26 (76.5)	<0.001
Schirmer I test, mm				
Right eyes	15.10 ± 6.78	12.15 ± 4.93	10.05 ± 6.75	0.004
Left eyes	15.73 ± 7.68	13.61 ± 6.31	10.48 ± 7.07	0.01
TBUT, s				
Right eyes	11.36 ± 2.92	9.69 ± 3.68	7.08 ± 2.56	<0.001
Left eyes	12.02 ± 3.20	10.09 ± 3.29	7.51 ± 2.76	<0.001
Cochet-Bonnet score, cm				
Right eyes	4.71 ± 0.34	4.46 ± 0.42	3.50 ± 0.81	<0.001
Left eyes	4.69 ± 0.35	4.48 ± 0.45	3.51 ± 0.84	<0.001
Cochet-Bonnet score				
≥4.5 (normal)	20 (52.6)	8 (29.6)	3 (8.8)	
4–4.49 (borderline)	18 (47.4)	18 (66.7)	10 (29.4)	
<4.0 (abnormal)	0 (0)	1 (3.7)	21 (61.8)	<0.001

Data are mean ± SD or n (%). PN−, absence of diabetic PN; PN+, presence of diabetic PN.

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