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Research Article

# Recent Advances in Research on Association of Type 2 Diabetes Patients and Dry Eye Disease

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## Abstract

Dry eye disease is a condition with poor vision low tear production and redness of eye. It is caused by infection, environment, medication, age and diseases. Type 2 Diabetes is chronic metabolic disorder with high blood glucose level which leads to organ failure and death. Diabetes is caused by genetics, old age, obesity, unbalanced diet, hypertension e.t.c. Recent years have witnessed an increase in prevalence of dry eye disease in type 2 diabetes patient. The recent research on the positive correlation of these diseases is stated in this review.

**Keywords:** Dry Eye Disease; Type 2 Diabetes; Ophthalmology; Tear Quality

## Introduction

Dry eye disease or keratoconjunctivitis sicca is a condition with low tear production or poor-quality tear production. Tears are eye lubricants which ensure and maintain healthy vision. Tears protect eye from infection and foreign objects. Dry eyes are red, irritant and uncomfortable. Blurred vision, sensitivity to light and excessive tearing are also conditions experienced by patients. Factors contributing to onset of disease are aging, autoimmune diseases, consumption of antidepressants, antihistamines and decongestants. Women are likely to develop this condition during menopause due to hormonal changes. Weather, bad climate and long-term use of contact lenses also contribute to dry eye symptoms [6].

The dry eye disease is a multifactorial condition of tear glands dryness which causes damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort. The tear film of the eye is damaged or instable which leads to subacute inflammation and high osmolarity of the tear film. The ocular surface with lacrimal gland and meibomian glands is main functional units. All these structures of eye dry out and are inflamed. Dry eye disease is an autoimmune disease along with stress caused by environment, infection, endogenous stress, antigens and genetic factors. The ocular surface and lacrimal glands are infiltrates by T helper cells, chemokines, cytokines and matrix metalloproteinases [7,8].

The treatment strategies include induction of artificial tears, lubricating eye drops, modification in lifestyle, change in environment, prescription drugs and surgery to improve tear preservation or quality [6].

Type2 diabetes mellitus is a chronic metabolic disorder with high blood sugar levels. The relative insulin resistance or deficiency indicates ineffective production of insulin or effectiveness of body's cells to respond to insulin. The blood sugar is regulated by insulin and ensure sugar uptake for necessary cellular functions. Overtime diabetes leads to damage to tissues and organs.

Type 2 diabetes is associated to genetics, old age, obesity, unbalanced diet, hypertension e.t.c. Symptoms characterized with type 2 diabetes are excessive thirst, frequent urination, abrupt weight gain or loss, fatigue, blurred vision, slow healing, numbness. The treatment begins with change in lifestyle by change in balanced diet, regular physical activity and weight management. Drugs are

employed to lower blood sugar level and increase insulin production. Blood glucose is regularly measured and managed [4].

The incidences of dry eye syndrome with type 2 diabetes together are more common in recent years. These conditions together compromise quality of life further [14]. The patients with diabetes were studied for dry eye symptoms, presence of diabetic retinopathy, low quality of life and duration of diabetes. 49% of subjects with dry eye diseases symptoms are associated with low quality of life and are prevalent in patients with type 1 and type 2 diabetes [13].

The ocular surface microbiota was studied to understand any relationship with diabetes and dry eye disease. The patients with both dry eye disease and diabetes had a more complex microbiota in comparison to patients with only diabetes or only dry eye disease. Clostridiales and Lactobacillus microbiota were prevalent in patients with both diabetes and dry eye disease. All other patients have diverse core microbiota groups [15].

Study proved higher prevalence of dry eye disease in kids suffering with diabetes. Corrected visual acuity, corneal sensation and high glycosylated hemoglobin was reported in relation to offset of dry eye disease [10].

Association of dry eye disease with diabetic retinopathy in Pakistan was analyzed. Blood glucose levels were analyzed patients with type 2 diabetes patients. Dry eye disease syndrome was associated with gender, age, tear meniscus height, duration of diabetes and blood sugar random. Old age is a significant contributing factor to link diabetic retinopathy and dry eye disease [5]. Study in North Caroline was conducted to understand racial and ethnic differences associated with diabetes and dry eye disease. The racial and ethnic groups analyzed were Non-Hispanic White, Non-Hispanic Black/African American, Asian, and Hispanic. The highest prevalence for diagnosis of dry eye disease was recorded for Asian patients with diabetes [11].

Undiagnosed dry eye illness was present in an 80-year-old patient undergoing cataract surgery who also had diabetes and seropositive rheumatoid arthritis. The patient underwent repeated corneal gluing for corneal perforation to treat bilateral moderate-severe dry eye syndrome. Corneal melt was the end outcome. The study's conclusion emphasizes the significance of careful preoperative treatment of the ocular surface assessment. Get the requisite ocular evaluations for patients with systemic disorders receiving topical nonsteroidal anti-inflammatory medications [9].

Corneal sensitivity was assessed in type 2 diabetes mellitus patients by Schrimer I test, tear film break-up time, tear meniscus measurement, eye dryness questionnaire and sodium fluorescein staining. Corneal structure was assessed in vivo by confocal microscope, while nerve fiber length and inferior whorl length were assessed by neural structures. All results indicated towards positive correlation of corneal sensitivity in type 2 diabetes patients [2].

Alpha-lipoic acid is a dithiol micronutrient with anti-oxidative properties. By reducing the expression of matrix metalloproteinase-9 in corneal epithelial cells, it shields the eye against dryness. The antioxidant potential guarantees protection against injury to the lachrymal gland and ocular surface. Nuclear factor-kappa B and O-linked N-acetylglucosamine transferase activity are inhibited by alpha-lipoic acid to reduce oxidative stress. In the ganglion cells of the retina, the AMP-activated protein kinase and erythroid-2-related factor 2 are activated. Research on diabetics who were at risk of developing retinopathy showed that alpha-lipoic acid protected the retina and reduced inflammation [1].

The regulatory role of peroxisome proliferator-activated receptor (PPAR) family in lacrimal gland dysfunction under desiccating stress or diabetes [16]. PPARs expression in cornea, conjunctiva, meibomian gland, and lacrimal gland in adult rats was examined by qPCR. Expression of PPARα as well as PPARβ/δ were seen in lacrimal gland and conjunctiva. PPARγ expression was also recorded in the same regions but was higher. The tear secretion was lower while corneal staining was recorded higher. The PPARγ is a potential candidate for environmental, stress and diabetes-induced dry eye disease [3].

Research has proven apoptosis-inducing effect of APX-115A on Epstein-Barr virus-infected retinal epithelial cells. It is a pan-nicotinamide adenine dinucleotide phosphate and was studied for any association to dry eye disease. Diabetic sprague Dawley rats were injected strptozotocin via intraperitoneal route. The rats' eyeballs were exposed to APX-115A or saline water. The tear secretion was measured, morphology of eyeball/lacrimal gland was determined by H and E staining. Morphological variations were observed in acinar atrophy and intracellular vacuoles due to APX-115A treatments. By immunohistochemistry NADPH 2 was detected in lacrimal glands yet decreased expression was recorded in treatment groups. Tear secretion increased in APX-115A rats. The study concluded APX-115 A as a potential treatment option for dry eye disease [17].

The lipid composition of meibum was studied in patients with type 2 diabetes and dry eye diseases. HPLC-MS analysis was analyzed and concluded with low triacylglycerol and wax esters. It has been also reported that the(O-acyl)-omega-hydroxy fatty acids (OAHFA) levels were significantly decrease in diabetes mellitus and dry eye disease as compare to the normal healthy controls, while phospholipids and cholesteryl Ester were higher. The type 2 diabetes influences expression of meibum lipids to aggravate dry eye disease [12].

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