

Dry eye disease in strabismus patients: Does eye deviation harm ocular surface?



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A B S T R A C T

Introduction: Dry eye disease is a multifactorial disease which affects the ocular surface system, and determines ocular discomfort symptoms and visual disturbance. Various types of ocular surgery, including strabismus one, represents a recognized cause for iatrogenic dry eye. However, it is not uncommon that strabismus patients, even not undergone to surgery, report symptoms of ocular discomfort and dryness.

Hypothesis

We hypothesize that two possible mechanisms may determine dry eye in strabismus patients by setting up a specific vicious circle: firstly, the increased exposure of the area of the bulbar conjunctiva located on the opposite side compared to the deviation may cause the thinning of the tear film lipid layer, with increased tear film instability; secondly, the dysfunctional lubricity secondary to the altered relationship between the eyelids and the deviated globe may cause blinking-related microtrauma, and thus inflammation and tear hyperosmolarity. These two entry points into the vicious circle of dry eye may determine a cascade of detrimental mechanisms, leading to further damage of the tear film, thus closing the disease circle.

Discussion: Strabismus patients may be affected by signs and symptoms of dry eye syndrome. The increased exposure of the bulbar conjunctival area along with the dysfunctional lubricity between the eyelids and the deviated eye could be the main underlying pathophysiological mechanisms acting as entry points into the vicious circle of dry eye disease. If our hypothesis was to be confirmed, ocular surface parameters should be routinely investigated in strabismus patients, while the use of tear substitutes with the aim of moistening and nourishing the ocular surface could help in reducing dry eye signs and symptoms.

Introduction

Dry eye (DE) disease is a multifactorial disease affecting the ocular surface system, and determining ocular discomfort and visual disturbance [1]. In recent years, ocular surface disease and in particular dry eye have become increasingly common complaints at Ophthalmic practices, with a prevalence ranging from 7.4% to 33.7% according to classification criteria and study population [2–4]. The underlying core mechanism is arranged in a vicious circle, self-sustained through tear film instability, inflammation, apoptosis, and hyperosmolar stress [5]. DE symptoms include foreign-body sensation, pain, irritation, ocular fatigue and eye redness, impairing patient's quality of life and restricting daily activities [6,7]. Major risk factors of DE disease are represented by increasing age, female sex, contact lens wearing, low humidity environment, androgen deficiency and the use of systemic medications as antihistamines and antidepressant [1]. Ocular surgery

including cataract [8], photorefractive keratectomy [9] and laser-assisted in situ keratomileusis [10] represent other well recognized causes of dry eye disease. Therapy aiming to improve signs and symptoms is driven by risk factors and disease severity levels [11–13].

Recently, the onset of DE symptoms has been reported also after strabismus surgery, due to changes of corneal sensitivity, increase of tear film instability and depletion of goblet cells [14,15]. However, in our personal experience it is not uncommon that strabismus patients report symptoms of ocular discomfort and dryness already before surgery. This anecdotal observation, not yet confirmed by scientific evidence, arouse our suspicion of a possible link between dry eye disease and strabismus.

Hypothesis

In strabismus patients, the two visual axes do not intersect at the

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Fig. 1. Increased exposure of the temporal side of the bulbar conjunctiva in a patients affected by esotropia in the right eye.

point of fixation because of an abnormal alignment of the eyes. Ocular deviation can be intermittent or, in more severe cases, permanent. We hypothesize that the deviation of the eye from the primary position may result in chronic alterations of the ocular surface, leading to DE through two possible mechanisms.

Firstly, the deviation of the eye causes an increased exposure of the area of the bulbar conjunctiva located on the opposite side (Fig. 1). This abnormal exposure may determine the thinning of the tear film lipid layer, with increased tear film instability, evaporative tear loss and tear hyperosmolarity.

Secondly, the anatomical and functional relationship between the eyelids and the globe are chronically altered in eyes deviated from the primary position. This feature may determine a dysfunctional lubricity, thus causing blinking-related microtrauma due to the increased mechanical friction of the eyelids over the conjunctival epithelium. Both the tear hyperosmolarity secondary to tear film instability and the mechanical damage of the conjunctival epithelium during blinking may activate a cascade of inflammatory events, that in turn lead to further damage of ocular surface system, thus setting up a specific vicious circle (Fig. 2).

These two entry points into the vicious circle of dry eye disease may determine a cascade of detrimental mechanisms, leading to further damage of the tear film, and thus closing the circle.

This proposed hypothesis is supported by preliminary data of our pilot study, which evaluated ocular surface changes in strabismus patients undergoing surgery (unpublished data). Patients with horizontal strabismus, not affected by any systemic disease potentially impairing ocular surface health (e.g. dysthyroidism, diabetes, and autoimmune diseases such as Sjögren’s syndrome), were included in the analysis. Ocular Surface Disease Index (OSDI) questionnaire showed the presence of mild to moderate DE symptoms in strabismus patients already before surgery (mean score 26.5; pathological score > 12). The bulbar conjunctiva located in the opposite side of the eye deviation (i.e. temporal side for esotropic patients, and nasal side for exotropic patients) was analysed by both impression cytology and in vivo confocal microscopy (Fig. 3). These analyses revealed reduced number of goblet and epithelial cells, as well as reduced nucleocytoplasmic ratio in strabismus patients compared to age and sex matched healthy controls (Table 1). These cytological modifications are considered markers of squamous metaplasia, a typical sign of dry eye disease, and were

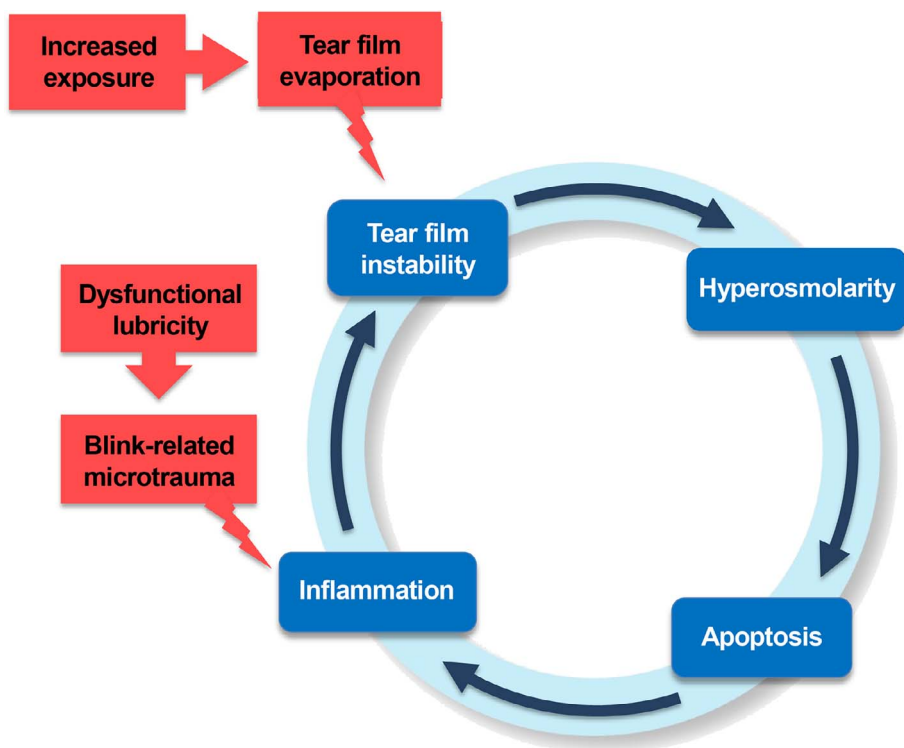


Fig. 2. Proposed vicious circle of dry eye disease in strabismus patients. The increased exposure and the dysfunctional lubricity represent the two mechanisms acting as entry points into the circle. Modified from Baudouin C, et al. Ocul Surf 2013;11:246–258 [ref 5].

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