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Research Article

The role of Dex panthenol Eye Drops in Treating Keratoconjunctivitis Sicca (Dry Eye Disease)

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Abstract

Background: Keratoconjunctivitis sicca (KCS), commonly known as dry eye disease, is a multifactorial condition characterized by symptoms of eye dryness, burning, irritation, and blurred vision, and can be accompanied by corneal epithelial damage. Treatment options have primarily focused on symptomatic relief through lubricants and immunosuppressive agents. Dex panthenol, a provitamin of B5, has emerged as a potential therapeutic agent due to its role in promoting epithelial healing and improving tear film stability.

Objective: This paper reviews the role of Dex panthenol-containing eye drops in the treatment of KCS, with a focus on their efficacy in healing corneal and conjunctival epithelial damage and improving dry eye symptoms.

Methods: A comprehensive review of relevant published studies was conducted.

Results: Several studies reported significant improvements in corneal epithelial integrity and tear film stability with the use of Dex panthenol-containing eye drops. Notable improvements in subjective symptoms of dryness, irritation, and ocular discomfort were observed, particularly in post-surgical and trauma-induced dry eye cases. The studies consistently highlighted Dex panthenol's role in accelerating epithelial healing and reducing ocular surface defects.

Conclusion: Dex panthenol shows significant potential in the management of KCS, providing both symptomatic relief and enhanced epithelial repair. It offers a promising alternative or adjunct to traditional treatments, especially for patients requiring long-term support for epithelial regeneration.

Keywords: keratoconjunctivitis sicca; dex panthenol; eye drops

Introduction

Keratoconjunctivitis sicca (KCS), commonly referred to as dry eye disease, is a heterogeneous condition that presents with a variety of symptoms, ranging from mild to severe. Common symptoms include eye dryness, burning, irritation, redness, discharge, and easily fatigued eyes. In more severe cases, blurred vision can occur. While KCS is typically associated with insufficient tear production, it can occasionally present with excessive tearing or discharge, which can further complicate its clinical diagnosis and management.

The prevalence of KCS has been increasing, with lifestyle factors such as prolonged computer use, reading, driving, watching television, and exposure to windy or dusty environments being linked to the condition. Additionally, individuals who wear contact lenses or have undergone LASIK surgery may also be at an elevated risk.

The term "dry eye syndrome" was first described in 1893 by Wagenmann, who reported corneal and conjunctival disturbances due to deficient lacrimation. Wagenmann observed two cases of acquired lacrimal deficiency: one resulting from a skull fracture and the other from the surgical removal of the lacrimal gland. These cases were associated with punctate corneal opacities and epithelial thickening. Over time, further studies have solidified the link between tear deficiency and various corneal abnormalities, including symptoms of dryness and photophobia.

The occurrence of symptomatic chronic conjunctivitis and keratitis associated with punctiform opacities, sometimes with filaments, associated with inadequate lacrimal secretion and manifested by dryness of the eyes and photophobia has been reported as early as 1919 in postmenopausal females (A Fuchs, 1919; Schoninger, 1924; Scheerer, 1928; Betsch, 1928; Ishikowitz, 1928). Many of these cases were associated with defective

secretion of salivary glands of the mouth and the sweat glands of the skin [1-6].

In 1930, William Stewart Duke-Elder (Figure-1A) from London introduced the term "keratitis sicca," referring to keratitis associated with punctiform opacities and often accompanied by chronic conjunctivitis and viscous discharge. He reported a five and a half years boy who had chronic photophobia attributed to congenital complete absence of tears. The boy also experiencing a viscous sticky secretion on the lids during early childhood. Examination revealed punctate corneal opacities.

Duke-Elder suggested that keratitis associated with punctiform opacities, sometimes with filaments, and usually accompanied by a chronic conjunctivitis, manifested by some viscous secretion, can result from congenital or acquired tear deficiency is a well-defined clinical entity, which he called “Keratitis sicca” [7].

Later, Henrik Sjögren’s seminal work in the 1930s further elucidated the relationship between dry eyes and systemic conditions such as arthritis, coining the term "keratoconjunctivitis sicca."

Figure-1A: William Stewart Duke-Elder (22 April 1898-27 March 1978), a Scottish ophthalmologist

In 1930, Henrik Sjögren (Figure-1B) reported a patient with poor lacrimal salivary glands secretion associated with symptoms of dry eyes which were described by Sjögren as keratoconjunctivitis. In 1933, Sjögren’s published doctoral thesis included a description of nineteen females who had arthritis and Keratoconjunctivitis sicca, unrelated to xerophthalmia which results from vitamin A deficiency. In 1951, he described 80 patients with kerato-conjunctivitis sicca, 50 of whom also had arthritis [8, 9].

Figure-1B: Henrik Samuel Conrad Sjögren (July 23. 1899-September17, 1986) a Swedish ophthalmologist

Over the decades, multiple treatments have been developed for KCS, ranging from artificial tear solutions to immunosuppressive therapies.

Artificial tear eye drops have been increasingly used in the treatment of keratoconjuctivitis sicca since the 1960s, including the solution of carboxymethyl-cellulose at pH 8 5 plus sodium bicarbonate and sodium chloride which was devised by Jones and Coop. Jones and Coop also reported the beneficial use of acetylcysteine a mucolytic agent in 15 patients with keratoconjunctivitis [10].

In 1968, Absolon and Brown reported a double-blind cross-over study compared the beneficial effects of N-acetyl-L-cysteine (A derivative of the amino-acid L-cysteine) with that of artificial tears devised by Jones and Coop in 30 patients with kerato-conjunctivitis sicca. The study showed that treatment with acetylcysteine was associated with much better objective benefit than treatment with artificial tears. Therefore, Absolon and Brown underscored the value of mucus in improving the corneal changes [11].

During the same year, Crompton suggested the use of Immuno-suppressive in the treatment of kerato-conjunctivitis [12]

In 2015, Wan and colleagues conducted a systematic review and meta-analysis which included 12 controlled studies involving 1367 patients with keratoconjuctivitis sicca. The study showed that cyclosporine (0.05%) eye drops 2 times a day can markedly improve the outcome of the condition [13].

In 2017, Groß and colleagues reported a study which showed that 0.2% and 0.18% hyaluronic acid eye drops can significantly improve symptoms and signs of keratoconjunctivitis sicca and are well tolerated with few side effects [14].

Methodology

A variety of studies have been conducted to assess the efficacy of dexpanthenol in the treatment of KCS. Below, we summarize key studies investigating the role of dexpanthenol in treating this condition:

Göbbels and Gross (1996): A controlled study involving 50 patients with dry eyes evaluated the use of dexpanthenol-containing artificial tears (Siccaprotect). The study found significant improvement in corneal epithelial permeability in patients who received dexpanthenol compared to those using placebo drops.

Raczyńska et al. (2003): In a study involving 80 eyes with corneal and/or conjunctival wounds, 40 eyes were treated with topical dexpanthenol (5% solution or gel). The results showed accelerated healing of corneal and conjunctival wounds in the treated group compared to the control.

Bujalková and Veselý (2004): A study involving 91 patients with dry eye syndrome demonstrated that dexpanthenol-containing eye drops were particularly effective in cases requiring epithelial support and for managing non-infectious inflammation associated with dry eyes.

Baumeister et al. (2004): A placebo-controlled study involving 18 patients with recurrent corneal erosion found that post-operative treatment with 5% dexpanthenol ointment led to a slightly faster healing time compared to placebo.

Köppe et al. (2023): In a study involving 49 patients with dry eye disease undergoing cataract surgery, treatment with sodium hyaluronate- and dexpanthenol-containing eye drops for 5 weeks significantly improved symptoms, ocular surface defects, and tear film stability.

Knorring (2023): This study reviewed the role of dexpanthenol in promoting the reparative processes of epithelial cells and suggested its potential in improving corneal healing following injury.

Results

Across the studies reviewed, dexpanthenol was found to provide significant clinical benefits for patients suffering from KCS or dry eye disease:

Corneal Epithelial Healing: Studies consistently reported that dexpanthenol promotes the healing of corneal wounds and improves epithelial permeability. For instance, Göbbels and Gross (1996) found notable improvement in corneal epithelial integrity following treatment with dexpanthenol-containing drops.

Accelerated Healing of Conjunctival and Corneal Wounds: Raczyńska et al. (2003) demonstrated that dexpanthenol significantly accelerated wound healing in corneal and conjunctival tissues, highlighting its potential in treating post-surgical or trauma-induced dry eye conditions.

Improvement in Dry Eye Symptoms: Studies such as Bujalková and Veselý (2004) and Köppe et al. (2023) noted significant improvements in dry eye symptoms, such as reduced discomfort, dryness, and redness. These improvements were associated with better tear film stability and reduced ocular surface defects.

Post-Operative Efficacy: In patients undergoing cataract surgery, Köppe et al. (2023) found that the combination of dexpanthenol and sodium hyaluronate eye drops enhanced ocular recovery and improved dry eye symptoms, especially in the post-operative period.

Discussion

The role of Dex panthenol in the management of Keratoconjunctivitis Sicca (KCS), commonly referred to as dry eye disease, is an area of increasing interest due to its potential to support epithelial healing and improve the symptoms associated with this chronic condition.

Dry eye disease is multifactorial, with causes ranging from insufficient tear production to environmental factors, and it can lead to significant discomfort and visual disturbances.

Traditional treatments for KCS have primarily focused on lubricants, anti-inflammatory agents, and immunosuppressive therapies. However, the potential of dexpanthenol, a provitamin of B5 has emerged as an effective adjunct, particularly due to its beneficial effects on epithelial repair.

Mechanisms of Action and Efficacy

Dexpanthenol's mechanism of action in the eye is rooted in its conversion to pantothenic acid, which is essential for the synthesis of coenzyme A, a key compound in cell metabolism.

Pantothenic acid plays a crucial role in cellular regeneration, particularly in epithelial tissues. This is significant for KCS patients, where epithelial damage is often a primary concern. By accelerating the healing of corneal and conjunctival epithelial cells, dexpanthenol helps to restore the integrity of the ocular surface, which in turn reduces symptoms of dryness, burning, and irritation.

The studies reviewed in this paper consistently report the positive effects of dexpanthenol on both objective and subjective measures of dry eye disease. For instance, Göbbels and Gross (1996) found marked improvements in corneal epithelial permeability in patients using dexpanthenol, highlighting its reparative properties. Similarly, Raczyńska et al. (2003) demonstrated that dexpanthenol expedited the healing of corneal and conjunctival wounds, providing a basis for its use in post-surgical or trauma-related cases of dry eye. The benefits of dexpanthenol appear to extend beyond just epithelial healing, as it has also been shown to improve tear film stability, reduce ocular surface defects, and alleviate dry eye symptoms.

Clinical Implications and Comparison with Other Treatments

Dexpanthenol's therapeutic potential stands out when compared to other common treatments for dry eye disease. Artificial tears, which are the mainstay of dry eye management, only provide temporary relief by lubricating the ocular surface but do not address the underlying epithelial damage. Dexpanthenol, on the other hand, appears to provide a more comprehensive solution by promoting epithelial regeneration, thus addressing both the symptoms and underlying pathology of dry eye disease.

In studies such as those by Bujalková and Veselý (2004), dexpanthenol-containing eye drops showed significant improvement in both subjective symptoms (e.g., dryness and irritation) and objective clinical measures (e.g., tear film stability and ocular surface defects). This dual benefit underscores the potential of dexpanthenol as a more holistic treatment option compared to purely symptomatic approaches.

Another important consideration is the safety profile of dexpanthenol. Unlike immunosuppressive therapies, such as cyclosporine, which carry the risk of systemic side effects, dexpanthenol is typically well-tolerated with minimal adverse effects. This makes it a promising option for long-term use in managing dry eye disease without the concerns associated with more aggressive therapies.

Conclusion

The use of dexpanthenol eye drops in the treatment of Keratoconjunctivitis sicca appears to offer significant therapeutic benefits, particularly in promoting corneal epithelial healing and improving dry eye symptoms. Multiple studies have demonstrated that dexpanthenol not only accelerates wound healing but also supports the integrity of the ocular surface, offering patients a viable option in the management of dry eye disease. The existing evidence suggests that dexpanthenol could be an effective adjunctive therapy, especially for patients requiring enhanced epithelial support or post-operative care.

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Conflict of interest: None.

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