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Artificial Tears and the 20-20-20 Rule in Screen-Related Dry Eye Disease Therapeutic Principles and Clinical Application

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Abstract

Background: Artificial tears are a principal first-line therapy for dry eye disease. They supplement the natural tear film, improve lubrication, and reduce irritation, burning, foreign-body sensation, and fluctuating vision. Formulations differ in viscosity, retention time, preservatives, lipid components, electrolytes, and osmolarity. Clinical response varies among patients. Screen-related symptoms are also influenced by prolonged near viewing, reduced or incomplete blinking, and visual fatigue. The 20-20-20 rule introduces regular visual breaks by encouraging users to look at a distant object.

Objective: To review the mechanisms of action, formulation differences, classification, clinical effects, safety considerations, and individualized selection of artificial tears. The review also examines the role of the 20-20-20 rule for reducing discomfort associated with prolonged screen exposure.

Conclusion: No single artificial tear formulation is suitable for every patient. Selection should reflect the predominant tear film deficiency, symptom pattern, required duration of relief, frequency of use, and tolerance of preservatives. More viscous preparations may remain longer on the ocular surface but may cause temporary visual blurring, whereas less viscous drops may require frequent application. Preservative-free preparations may be preferable for frequent use or sensitive ocular surfaces. Patients should receive instructions on correct use and should be reassessed when symptoms persist. The 20-20-20 rule interrupts continuous near work, relaxes sustained visual effort, and encourages complete blinking. It does not replace clinical evaluation or treatment for persistent dry eye disease. Combining individualized tear supplementation with structured visual breaks, conscious blinking, and appropriate screen-use habits may support symptom control, tear film stability, visual comfort, and ocular surface health.

Keywords: Artificial Tears; 20-20-20 Rule; Dry Eye Disease; Digital Eye Strain; Ocular Surface

Introduction

Artificial tears remain a principal first-line therapy for managing dry eye disease (DED), providing lubrication to reduce symptoms like irritation, burning, and fluctuating vision. They act as tear substitutes that supplement natural tears and improve ocular surface hydration. Despite their widespread use, effectiveness varies across formulations and patient subgroups, with recent research exploring both clinical benefits and limitations of diverse artificial tear products. [1]

Artificial tears work primarily by increasing tear film stability and reducing ocular surface friction. Several classes of active and supportive components contribute to their function. [2]

The 20-20-20 rule is a simple visual hygiene practice designed to reduce symptoms of digital eye strain (DES) and dry eye caused by prolonged screen viewing. [3]

Treatment of Dry Eye Syndrome

Treatment depends on the severity and cause of the condition.

Artificial Tears are lubricating eye drops that help keep the eyes moist. They are the first line of treatment and can be used several times a day.

Ointments and Gels used mainly at night, these provide longer-lasting lubrication.

Warm Compresses and Lid Hygiene applying warm compresses helps open blocked Meibomian glands and improves oil secretion. Cleaning the eyelids reduces inflammation and bacterial growth.

Medications as Prescription eye drops such as anti-inflammatory medications may be used to reduce inflammation and increase tear production.

Punctal Plugs Small devices inserted into the tear drainage ducts to keep tears on the eye surface longer. [4, 5]

Artificial Tears

Mechanisms of Action and Formulation Differences

For example, Osmo-protectants like trehalose and amino acids help shield epithelial cells from hyperosmolar stress, a major driver of cell damage in DED. High-molecular-weight hyaluronic acid (HA) enhances water retention on the ocular surface and protects epithelial cells from desiccation more effectively than some traditional polymers. [2]

These properties improve tear retention and extend residence time on the ocular surface, leading to longer-lasting relief. [2]

Different artificial tear ingredients also target specific layers of the tear film (aqueous, mucin, lipid), with lipid-containing formulations showing particular promise in evaporative dry eye, a subtype driven by excessive tear evaporation. [2]

Clinical Symptom Relief and Objective Improvements

Multiple clinical studies demonstrate that regular use of artificial tears leads to meaningful symptomatic improvements for many patients with DED. [1]

A recent systematic review found that regular use about four times daily significantly improved subjective symptoms within one month of treatment, although objective signs like ocular surface staining and tear film stability often take longer to show measurable improvements. Combination formulations (e.g., those containing both polymers and Osmo-protectants) generally performed better than simple, single-ingredient products. [1]

In a large comparative clinical trial, various artificial tear formulations (including carboxymethylcellulose, polyethylene glycol, and sodium hyaluronate–based products) all improved tear film stability shortly after instillation. However, sodium hyaluronate (HA)-based tears were reported to provide greater subjective symptom relief than other lubricants, highlighting the importance of ingredient selection in optimizing patient comfort. [6]

A specific study evaluating artificial tears with both trehalose (3%) and hyaluronic acid (0.15%) found significant reductions in dry eye symptom scores and improvement in tear break-up time and conjunctival redness after three months of consistent use, indicating sustained benefits across age groups. [7]

Classification of Artificial Tears

Based on Tear Film Target Layer (Functional Classification):

A. Aqueous-based (Muco-aqueous layer substitutes) are Most traditional artificial tears, improve hydration and lubrication and increase viscosity and retention time

Examples of ingredients:

Carboxymethylcellulose (CMC)

Hydroxypropyl methylcellulose (HPMC)

Hyaluronic acid / sodium hyaluronate

Polyvinyl alcohol (PVA), polyethylene glycol (PEG)

B. Lipid-based (Evaporative dry eye targeted) are Designed for meibomian gland dysfunction (MGD), Restore tear film lipid layer → ↓ evaporation and particularly beneficial in evaporative dry eye

Examples:

Liposomes

Mineral oils / castor oil emulsions

C. Mucin-enhancing agents are improving tear film stability & spreading

Examples:

Carbomer gels

HP-guar (hydroxypropyl guar)

D. Osmoprotective / cytoprotective formulations (NEWER CLASS): Protect epithelial cells from hyperosmolar stress

Examples:

Trehalose

Erythritol

L-carnitine

Based on Composition (Pharmacological Classification)

A. Cellulose derivatives

- CMC
- HPMC
- methylcellulose

B. Polyols (demulcents)

- Glycerin
- PEG
- Propylene glycol

C. Polymers

- PVA
- Polyvinyl pyrrolidone

D. Hyaluronic acid–based

- High water retention + non-Newtonian behavior (mimics natural tears)

Based on Formulation & Viscosity

A. Low viscosity drops

- Mild dry eye
- Frequent use

B. Moderate viscosity gels

- Longer retention

C. High viscosity ointments

- Severe dry eye
- Usually night use

Based on Advanced Formulation Technology (Modern Classification)

- Emulsions
- Oil-in-water systems
- For lipid deficiency

B. Nanoemulsions / microemulsions (NEWER)

- Improved penetration & stability

C. Liposome sprays

- Target lipid layer externally

Based on Preservative Content

A. Preserved artificial tears

- Contain BAK, polyquad, etc.

B. “Vanishing” preservatives (modern safer type)

- Sodium perborate
- Purite

C. Preservative-free (PF)

- Preferred in moderate–severe dry eye
- Reduce toxicity risk

Based on Clinical Use (Practical Clinical Classification)

- Lubricating drops (standard artificial tears)
- Lipid-enhancing drops (MGD-specific)
- Gel/ointment formulations (severe DED)
- D. Combination formulations (multi-layer targeting)

* Often more effective than single-agent drops [5, 2, 1]

Polyfresh Extra Single Dose Unit (SDU) is a preservative-free artificial tear formulation designed to provide multi-mechanism lubrication and protection of the ocular surface. It contains a combination of sodium

hyaluronate (0.1%), carboxymethylcellulose (0.5%), and glycerin (0.9%), which act synergistically to enhance tear film stability and prolong ocular surface hydration. [8]

Sodium hyaluronate is known for its viscoelastic and water-retentive properties, allowing it to mimic natural tears and improve epithelial healing, while carboxymethylcellulose increases viscosity and retention time on the corneal surface. Glycerin functions as a demulcent and Osmo protective agent, reducing tear film hyperosmolarity and protecting epithelial cells from desiccation stress. [8]

In addition, the formulation includes essential electrolytes such as calcium, magnesium, potassium, and sodium, which help maintain physiological tear composition and support corneal epithelial health. [8]

Polyfresh Extra SDU is presented in single-dose units, ensuring sterility and eliminating the need for preservatives, thereby minimizing ocular surface toxicity and making it particularly suitable for frequent use, contact lens wearers, and post-surgical patients such as after LASIK. Clinically, it provides both immediate and sustained relief of dry eye symptoms, including burning, irritation, and foreign body sensation, and is effective in conditions such as evaporative dry eye, aqueous deficiency, and environmental or visual stress-related dryness. [8]

This type of combination formulation reflects the modern trend in artificial tears toward multi-layer tear film replacement and cytoprotection, rather than simple lubrication alone. [5, 8]

Safety Considerations and Public Health Concerns

While artificial tears are generally safe, recent reports highlight rare but serious safety concerns. [9, 10]

An outbreak of multidrug-resistant Pseudomonas aeruginosa infections has been linked to certain preservative-free artificial tears, prompting calls for expanded safety evaluations and reinforcing the importance of proper product handling and sterility. [10]

This outbreak underscores the need for continuous surveillance and potentially more rigorous guidelines around artificial tear products. [10]

In addition, preservative-free formulations are typically recommended for frequent use since preservatives found in some products may exacerbate ocular surface inflammation with long-term application. [11]

Variability in Response and Personalized Selection

Recent comparative research presented at major scientific meetings indicates that no single artificial tear formulation outperforms all others across every tear film metric, such as tear meniscus height, breakup time, and lipid layer thickness. This suggests that individual patient factors including tear film dysfunction subtype (aqueous-deficient, evaporative, or mixed), lifestyle, and symptom profile should guide artificial tear selection. Tailoring treatment to the patient's specific tear film characteristics may yield better therapeutic results. [6, 1]

The 20-20-20 Rule

It recommends that for every 20 minutes spent looking at a digital display, a person should take a break by looking at something at least 20 feet away for about 20 seconds. This practice helps relax the eye's focusing mechanism and encourages more frequent blinking, which in turn supports tear film distribution and reduces eye surface irritation that occurs when blink rates drop during screen use. [3]

One physiological explanation for these benefits lies in blink behavior. Under normal conditions, humans blink approximately 15 times per minute, maintaining a healthy tear film. However, during continuous screen use, blink rates can fall sharply, leading to incomplete blinking and faster tear evaporation, which provokes dryness and irritation. The 20-20-20 rule's structured breaks help interrupt continuous near focus and remind users to blink more regularly, aiding ocular surface lubrication. [3]

Because users often forget to take these breaks naturally, reminder apps and timers are commonly recommended. Tools such as specialized eye-care timers, browser extensions, or mobile apps can automatically prompt users every 20 minutes to look away and blink, making the 20-20-20 pattern easier to follow consistently a key factor in achieving symptomatic relief. [3]

Research studies used such reminder software to ensure compliance with the rule and observed symptom improvements, suggesting that technology-assisted reminders enhance the practical application of the rule. [3]

For individuals experiencing persistent symptoms, using these tools alongside other ergonomic measures can be a practical, low-cost approach to maintaining eye comfort. [3]

Mechanism of the Rule

The 20-20-20 rule helps alleviate dry eye primarily by interrupting prolonged near focus and encouraging visual breaks, which temporarily shifts the eyes' focus to distant objects. This reduction in continuous near work relaxes the ciliary muscles that control lens shape for focusing, thereby lowering visual fatigue that contributes to discomfort during extended screen use. Frequent breaks also give the eyes a rest from sustained accommodation, a factor implicated in digital eye strain and associated dryness symptoms. [3]

- A key aspect of dry eye during screen use is the reduction of spontaneous blink rate. Normally, humans blink about 15–20 times per minute, which spreads tears evenly across the ocular surface to maintain moisture. However, intense visual attention on screens can decrease blink frequency to as low as 5–7 blinks per minute, leading to tear film instability and increased evaporation, both central contributors to dry eye symptoms. By prompting regular breaks, the 20-20-20 rule helps restore a more natural blink pattern, which supports lubrication and ocular surface health. [3]

In addition to frequency, the quality of blinking matters. During focused screen tasks, partial or incomplete blinks occur more frequently, reducing the effectiveness of each blink at redistributing the tear film. The visual break encouraged by the 20-20-20 rule not only increases blink rate but also tends to promote more complete blinks, which enhances tear spread and glandular oil expression, crucial for tear film stability and reducing dryness and irritation. [12]

- Research also suggests that increasing blink frequency has measurable effects on tear film parameters relevant to dry eye disease. Studies on blink dynamics indicate that reaching a threshold of around 20 blinks per minute is associated with improved tear meniscus height and tear break-up time, which reflect a healthier, more stable tear film and less evaporative stress mechanisms that help reduce dry eye symptom severity. [13, 14]
- Finally, clinical investigations incorporating the 20-20-20 rule show that using reminders or software to enforce regular breaks leads to fewer dry eye symptoms and reduced digital eye strain in screen users, even if structural tear film changes may require longer durations to manifest. These symptomatic improvements are likely due to combining visual breaks with increased and better blinking, demonstrating how behavioral modifications can positively influence ocular surface comfort during desktop or device work. [3]

Conclusion

No single artificial tear formulation is suitable for every patient, and selection should reflect the predominant tear film deficiency, symptom pattern, required duration of relief, frequency of use, and tolerance of preservatives. More viscous preparations may remain longer on the ocular surface but may cause temporary visual blurring, whereas less viscous drops may require more frequent application. Preservative-free preparations may be preferable when drops are used frequently or when the ocular surface is sensitive. Patients should be instructed in correct use and should be reassessed when symptoms persist or when relief remains inadequate. The 20-20-20 rule offers a simple approach to interrupt continuous near work, relax sustained visual effort, and encourage more complete blinking. Consistent reminders and integration into daily screen routines may improve adherence. The rule does not replace clinical evaluation or treatment when dry eye disease is

persistent. Combining individualized tear supplementation with structured visual breaks, conscious blinking, suitable environmental conditions, and appropriate screen-use habits may provide broader support for symptom control, tear film stability, visual comfort, and ocular surface health.

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