REVIEW ARTICLE

Epidemic Digital Eye Strain (DES) in the Screen Era: Pathophysiology, Stratified Epidemiology, and Lifestyle-Oriented Interventions

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Abstract

Background and Objective: Digital eye strain (DES), or computer vision syndrome, is a significant public health and occupational concern in the digital era. Prolonged screen exposure disrupts ocular surface homeostasis and accommodative function, increasing visual discomfort. This critical review examines the underlying pathophysiological mechanisms, classifies DES phenotypes, identifies epidemiological and behavioral risk factors, and proposes an integrated, lifestyle-oriented prevention framework.
Methods: A critical scoping review was conducted to synthesize the contemporary pathophysiological framework, epidemiological stratifications, and clinical-ergonomic-behavioral paradigms of DES. We examined the literature on screen-exposure-induced blink dynamics, tear film biochemistry, accommodative strain, and corresponding pediatric, academic, and occupational risks.
Results: Digital eye strain is an important public health and occupational concern associated with prolonged screen exposure. Sustained digital device use may impair ocular surface stability and accommodative function, resulting in visual discomfort. This critical review explores the pathophysiological mechanisms underlying DES, characterizes its clinical phenotypes, identifies key epidemiological and behavioral risk factors, and proposes an integrated lifestyle-based prevention framework.
Conclusion: DES is a direct consequence of a mismatch between evolutionary human visual biology and digital exposures. Effective mitigation requires a multi-layered prevention model combining behavioral blink-awareness training, ergonomic screen-distance optimization, structural visual breaks (e.g., the 20-20-20 rule), refractive optimization, sleep hygiene, and institutional policies. Addressing DES within a lifestyle medicine framework is essential to preserve long-term visual health, productivity, and quality of life in the screen era.
Keywords: digital eye strain, computer vision syndrome, tear film instability, blink rate, ocular surface disease, screen exposure, asthenopia, lifestyle medicine, ergonomics, public health.

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1. Introduction

The digital transformation of contemporary life has profoundly altered how human beings work, learn, socialize, and access information (1). Screens now mediate a large proportion of daily cognitive and visual tasks, with smartphones, tablets, laptops, desktop monitors, and wearable digital interfaces becoming integral to nearly every age group and occupational sector (1, 2). This structural shift has generated unprecedented visual exposure patterns characterized by prolonged near work, sustained fixation, reduced spontaneous blinking, and extended daily screen duration (2, 3). In parallel, complaints of ocular discomfort, blurred vision, tearing, dryness, headaches, and visual fatigue have become increasingly common in clinical practice (3). These symptoms, collectively recognized as digital eye strain (DES) or computer vision syndrome (CVS), reflect a convergence of ocular surface stress, accommodative load, and behavioral overuse (2, 3).

The concept of digital eye strain is particularly important within lifestyle medicine because it directly links a modern technological exposure to measurable physiological changes in the visual system (2, 3). Prolonged screen viewing requires sustained cognitive attention, fixed gaze, and repetitive visual accommodation at a close distance (3). Under these conditions, the blink rate decreases substantially, and the blinks that do occur are often incomplete (3, 6). This reduction in blinking disrupts the normal renewal of the tear film, increases evaporation, reduces tear stability, and exposes the corneal surface to desiccation and micro-irritation (3). As a result, the ocular surface becomes highly vulnerable to inflammation, epithelial stress, and symptom generation (3). This sequence is central to the pathogenesis of DES and explains why screen exposure is not merely associated with subjective fatigue but with biological disruption of ocular homeostasis (3, 6).

The burden of DES is expanding rapidly because digital device use is no longer limited to professional office environments (4). Educational systems increasingly depend on online learning platforms, virtual assignments, and prolonged mobile-based study (4). Social media and entertainment applications promote continuous scrolling and extended engagement, particularly among adolescents and young adults, while digital communication, telehealth, and online administrative tasks have increased exposure among older populations (4). This ubiquity means that visual stress is now distributed across the entire life course, affecting pediatric, adult, and geriatric populations alike (4, 5). The problem is compounded by widespread clinical underrecognition; many individuals fail to associate their visual fatigue and cognitive symptoms with digital device habits, leading to delayed diagnosis and a lack of preventive measures (4). This review evaluates the clinical and public health significance of DES, synthesizing its pathophysiology, classifications, epidemiological patterns, and multi-level lifestyle recommendations.

2. Pathophysiological Mechanisms and Clinical Phenotypes

Digital eye strain is best conceptualized as a multi-systemic syndrome rather than a single diagnosis (6). Its clinical manifestations arise from overlapping mechanisms involving the ocular surface, the tear film, accommodative and vergence systems, and central fatigue responses (6). Although the syndrome is often described in broad clinical terms, its pathophysiology can be organized into distinct, interconnected physiological domains (3, 6).

2.1 Ocular Surface and Tear Film Dysfunction

The most fundamental mechanism in DES is tear film destabilization (6). During normal viewing conditions, spontaneous blinking distributes the tear film evenly across the

cornea, restores a smooth optical surface, and clears debris (6, 8). Focused screen use suppresses blinking because visual attention is directed toward fixed, high-contrast digital content (6). The blink rate may fall markedly during device use, and the proportion of incomplete blinks may increase substantially (6). Incomplete blinking fails to fully spread the tear film, especially across the inferior cornea and the meibomian lipid layer, which accelerates tear evaporation and shortens tear breakup time (6).

As the tear film becomes unstable, the ocular surface is exposed to desiccating stress (6). Corneal and conjunctival epithelial cells respond with irritation, osmotic stress, and inflammatory signaling (6). Tear hyperosmolarity can amplify surface inflammation, creating a self-perpetuating cycle in which symptoms provoke further ocular irritation, which in turn worsens tear instability (6, 10). Clinically, this is experienced as dryness, burning, foreign body sensation, reflex tearing, and intermittent blurred vision (6). The fluctuating nature of symptoms is highly characteristic of tear-related DES because vision may improve momentarily after blinking and then degrade rapidly as the tear film breaks down again (6). The meibomian glands may also be involved; prolonged screen use and reduced blinking impair meibum secretion, contributing to evaporative dry eye (6, 10). In individuals with preexisting meibomian gland dysfunction (MGD), DES can become highly symptomatic because the lipid layer is already compromised (6). Contact lens wear, air-conditioned environments, low humidity, and dehydration may further intensify this process (6, 10).

2.2 Reduced Blink Rate and Incomplete Blinking

Blink suppression is the most direct physiological response to screen concentration (6). During reading or focused digital work, blinking becomes less frequent because cognitive attention is diverted from ocular surface maintenance (6). Each blink serves as a maintenance event for corneal lubrication and optical smoothness (6, 8). When blinks are reduced, the eye spends longer periods with exposed and evaporating tear film (6). Incomplete blinks worsen this effect because they fail to express the meibomian glands effectively and do not fully close the eyelids (6). Reduced blinking also disrupts ocular surface sensation (6). Normally, blinking protects the cornea from desiccation-triggered nociceptive stimulation (6). When the surface dries, sensory input increases and may be perceived as irritation, heaviness, or pressure (6). Some individuals respond by rubbing the eyes or squinting, which may temporarily reduce discomfort but can also worsen irritation (6).

2.3 Accommodative and Vergence Stress

DES is not limited to surface dryness (6). Digital work demands sustained near focus, which activates the accommodative system continuously (6). The ciliary muscle remains engaged to maintain clear vision at close range, and in some individuals this produces accommodative spasm, transient blur, or difficulty refocusing at a distance after prolonged screen use (6). Vergence mechanisms are also stressed because screen viewing typically occurs at a fixed close distance and may involve prolonged binocular convergence (3, 6). Individuals with latent heterophoria or convergence insufficiency may become symptomatic more quickly, reporting diplopia, frontal headache, or reading fatigue (6). When the accommodative system is overtaxed, symptoms may persist after the screen is removed, and the visual system may struggle to return quickly to far-distance clarity (6). This explains why some patients describe difficulty driving after long computer sessions or blurred distance vision after mobile-based study (6).

2.4 Visual Ergonomics and Environmental Contributors

The physical setup of screen use significantly influences symptom severity (6, 15). Poor screen height, improper viewing distance, glare, suboptimal font size, and excessive brightness all increase visual demand (6, 15). A screen positioned too high enlarges the palpebral aperture and worsens evaporation, while a screen placed too close increases accommodative demand and convergence load (6). Glare forces the patient to squint, which alters blink dynamics and increases muscular strain (6). Similarly, low ambient humidity, air conditioning, and fan exposure can intensify dryness (6). The content being viewed also matters; rapid scrolling, multitasking, and dynamic digital interfaces demand more intense attention than static text (6). Social media usage often involves repeated visual shifts and emotional engagement, which can prolong viewing sessions without adequate pauses (6). Display parameters also influence fatigue: immediate effects of light mode and dark mode features on visual fatigue in tablet users have been demonstrated, indicating that screen contrast and polarity directly impact accommodative comfort (7).

2.5 Phenotypic Classification of DES

To assist clinicians in tailoring interventions, DES can be classified into five distinct clinical phenotypes (see Table 1) based on the dominant pathophysiological presentation (6):

Table 1: Clinical Phenotypes of Digital Eye Strain and Lifestyle Medicine Significance

Clinical Phenotype	Primary Symptoms	Key Underlying Mechanism	Lifestyle Medicine Significance
1. Dry Eye-Dominant DES (6, 10)	Burning, dryness, foreign body sensation, tearing, fluctuating vision	Reduced blink frequency, incomplete blinking, meibomian gland stagnation, lipid layer instability	Behavioral blink-awareness, hydration, and environmental humidity control
2. Asthenopic DES (6)	Ocular fatigue, heaviness of eyelids, headaches, brow ache, difficulty concentrating	Accommodative overwork, ciliary muscle strain, extraocular convergence stress	Enforcing structural microbreaks (20-20-20 rule) and ergonomic screen placement
3. Refractive or Optical DES (6, 15)	Blurred vision, frequent squinting, rapid fatigue, need for constant refocusing	Uncorrected refractive error, poorly prescribed glasses, low-resolution displays	Regular comprehensive vision screenings and display optimization (contrast, size)
4. Accommodative Spasm / Dysfunction (6, 18)	Distance blur after screen work, transient myopic shifts, delayed distance focusing	Prolonged near-fixation, persistent ciliary muscle contraction, lack of focus relaxation	Alternating near-visual tasks with outdoor distance tasks and physical activity
5. Behavioral DES (11, 12, 19)	Compulsive screen scrolling, sleep-onset delay, physical exhaustion, neck/shoulder strain	Excessive device duration, lack of self-regulation, poor sleep hygiene, sedentary posture	Digital detox, cognitive behavioral lifestyle changes, and structured sleep hygiene

2.6 Relationship with Myopia Progression

An important and expanding clinical concern in pediatric and adolescent health is the relationship between intensive near-visual work, screen exposure, and myopia progression (8). While myopia is a complex, multifactorial condition influenced by genetic, environmental, and outdoor light exposure factors, prolonged near work and intensive screen use may contribute to axial elongation risk in susceptible individuals (8, 9). This issue is highly significant in modern lifestyle medicine because DES and myopia frequently coexist in young screen users (8, 10). Children with myopia may experience more severe visual discomfort during screen work because they are already dependent on optical correction and are more likely to use digital devices at suboptimal, highly close distances (8). Under these circumstances, screen-related near work acts as both a primary symptom generator and a potential behavioral contributor to refractive progression in vulnerable young populations (8, 9).

3. Epidemiological Stratification and Cohort Vulnerability

The epidemiology of DES is dynamically structured by changing patterns of screen exposure across the life course (2, 3). Prevalence estimates vary depending on the diagnostic definitions, population types, and measurement methodologies employed, but the syndrome is consistently highly prevalent across multiple global cohorts (3). What distinguishes this modern disorder is not merely its overall prevalence, but the way its clinical features and behavioral risk factors manifest differently across pediatric, adolescent, student, working-age, and geriatric populations (3, 6).

3.1 Pediatric Populations and Developmental Risks

Children are exposed to digital devices at increasingly early ages for educational instruction, entertainment, and social interaction, presenting unique developmental and physiological risks (8). In pediatric settings, DES may manifest as frequent eye rubbing, squinting, a noticeably reduced attention span during digital learning sessions, complaints of blurred vision, headaches, or general irritability (8, 9). Because younger children may not possess the self-awareness to describe their ocular discomfort directly, the condition is frequently underrecognized and misdiagnosed by parents and teachers (8).

Furthermore, pediatric screen use often occurs for prolonged periods with poor ergonomic control, which dramatically increases the risk of severe blink suppression and visual fatigue (8). Children are also highly prone to losing track of time during highly engaging tasks like video gaming or continuous streaming, failing to take voluntary visual breaks (8). In addition, excessive screen exposure in children frequently coexists with a decline in physical movement, poor sleep hygiene, and a dramatic reduction in outdoor play (8, 11). These clustered behavioral risk factors not only worsen subjective ocular strain but also negatively impact broader physical, psychological, and refractive development, positioning pediatric DES as a core component of a larger digital lifestyle syndrome (8, 11).

3.2 Adolescents and University Students

Adolescents and university students represent one of the highest-risk groups for DES because they merge heavy educational screen use with extensive recreational social media engagement, often characterized by a complete lack of self-regulation (9, 12). University students frequently spend long, uninterrupted hours on laptops, tablets, and smartphones, particularly during periods of remote learning, online assessments, and digital note-taking, which are associated with high expectations and sudden transition demands (12, 13). Common symptoms in this

cohort include ocular dryness, severe eye fatigue, blurred vision, headaches, heaviness of the eyelids, neck discomfort, and difficulty sustaining mental concentration (13).

Medical students and other high-intensity academic cohorts are exceptionally vulnerable (14, 15). These students spend prolonged periods studying complex digital materials under intense pressure, often with minimal breaks (15). Their visual burden was severely intensified by the rapid shifting to e-learning and online exams during the COVID-19 pandemic (14, 15). In these high-pressure cohorts, DES may drastically reduce study endurance and visual productivity, and is frequently wrongly attributed to general stress or psychological fatigue rather than to underlying ocular surface and accommodative dysfunction (14, 15). Furthermore, widespread deficits in students' knowledge, attitude, and preventive practices (KAP) regarding screen hygiene amplify the burden, as many do not maintain appropriate screen distances or take structured breaks (16, 17, 18). Compulsive social media dependence and late-night smartphone use in bed are major aggravating factors, extending cumulative visual exposure far into the nocturnal period and disrupting sleep patterns (11, 13).

3.3 Working-Age Adults and Occupational Exposure

Adults in the general workforce experience severe DES primarily through sustained occupational digital exposure (1, 6). Office employees, software developers, IT specialists, financial analysts, call-center operators, and remote workers commonly spend massive, uninterrupted blocks of time focused on computer monitors and secondary mobile displays (1). In this productive population, DES manifests as reduced reading speed, increased error rates, slowed visual processing, and recurrent tension-type headaches, which directly impair occupational performance and lower economic output (6). Occupational screen exposure is often intense, characterized by multi-display multitasking, rigid deadlines, and poorly designed workstations (1). Furthermore, adults carry multiple coexisting dry eye risk factors, including contact lens wear, age-related tear deficiencies, hormonal imbalances, systemic medications, and low-humidity office environments (6, 10). The modern professional culture of constant digital connectivity has blurred the boundaries between professional and personal life, leaving working adults with virtually no ocular rest across the day (1).

3.4 Geriatric Populations and Age-Related Vulnerabilities

In older adults, digital device usage has escalated rapidly due to the widespread adoption of telehealth services, digital banking, administrative tasks, and digital communication with families (6). Geriatric patients are uniquely vulnerable to DES because baseline tear production declines physiologically with age, and ocular surface resilience is frequently already compromised (6). Age-related presbyopia also places a severe accommodative and refractive burden on older users during near-visual screen tasks (6). Rather than reporting overt 'eye strain,' older adults are more likely to present with severe dryness, excessive tearing (reflex tearing), light sensitivity, and intermittent blurred vision (6). This is clinically critical because these symptoms frequently overlap with, or are obscured by, major age-related ocular pathologies—such as cataracts, glaucoma, dry macular degeneration, or systemic medication side effects—leading to significant underdiagnosis or misattribution of DES in geriatric care (6). When screen time increases in older adults, even brief exposure can trigger severe symptoms due to their lower baseline ocular reserve (6).

3.5 High-Risk Occupations and Behavioral Lifestyle Groups

Certain professional sectors carry exceptionally high risk due to their rigid,

unvarying near-visual demands (6). IT professionals, data-entry personnel, telecommunication staff, graphic designers, bank tellers, and online educators consistently report the highest prevalence and severity of DES (6). Remote workers are particularly vulnerable, as home-based workspaces are rarely ergonomically optimized compared to corporate environments, leading to poor monitor placement, bad lighting, and high screen glare (6). A newer, highly significant lifestyle cohort includes individuals with compulsive smartphone use, characterized by hours of continuous scrolling through social media feeds, short videos, and messaging apps (12, 19). This behavioral pattern is highly pathogenic because it typically occurs outside work hours, prolonging cumulative exposure (19). These users experience a destructive cycle of near-point convergence, prolonged blink suppression, and chronic circadian disruption due to late-night blue-light exposure, resulting in cumulative ocular and systemic fatigue (11, 12, 19).

4. Discussion and Lifestyle Medicine Perspectives

The core objectives of this critical review are to clarify the pathophysiological relationship between screen exposure and DES—emphasizing blink suppression as the central mechanistic node—to classify the syndrome into clinically useful phenotypes, and to map vulnerability across life-course cohorts to guide targeted lifestyle interventions (6). Synthesizing these dimensions reveals that DES is not merely a transient ocular discomfort but a highly complex, behaviorally-driven lifestyle disorder that demands systemic, lifestyle-oriented clinical management (6, 10).

4.1 Evolutionary and Lifestyle Mismatch

From a lifestyle medicine standpoint, DES represents a classic evolutionary mismatch (6). The human visual system evolved over millions of years to support dynamic, multi-distance, and highly physical outdoor behaviors in natural light (6, 8). Natural outdoor lighting promotes a healthy blink rate, supports proper tear film circulation, and allows the ciliary muscle to relax during far-distance viewing (8, 9). In contrast, the modern digital lifestyle demands that humans sit in sedentary, low-humidity indoor environments, focusing intently on artificial, high-contrast displays at a fixed near distance for hours on end (6). This dramatic mismatch between evolutionary biology and contemporary behavioral demands disrupts homeostatic ocular mechanisms, converting a temporary visual stressor into a chronic clinical and public health burden that compromises academic performance, workplace productivity, sleep hygiene, and overall quality of life (11, 13, 14).

4.2 Dietary and Nutritional Approaches in DES Management

Consistent with the holistic framework of lifestyle medicine, emerging evidence indicates that dietary and nutritional interventions can play a vital role in supporting ocular surface health and ameliorating DES symptoms (10). Specifically, a high dietary intake or targeted supplementation of omega-3 fatty acids has been shown to support the lipid layer of the tear film, reducing evaporative tear loss and mitigating ocular surface inflammation (10). Furthermore, macular carotenoids, such as lutein and zeaxanthin, accumulate in ocular tissues and are known to enhance visual performance by improving contrast sensitivity, reducing glare disability, and acting as biological filters for high-energy blue-light wavelengths emitted by digital screens (10). Incorporating structured nutritional counseling alongside physical and behavioral screen habits represents a powerful, multi-modal lifestyle intervention that addresses the biological susceptibility of the ocular surface from the inside out (10).

4.3 Key Research Gaps and Future Directions

Despite substantial clinical and public interest in DES, several critical research gaps remain in the literature (6, 10). First, the vast majority of current studies are cross-sectional, which severely limits causal inference and prevents a clear understanding of long-term ocular consequences (10). Longitudinal prospective studies are urgently needed to determine if chronic, unresolved DES accelerates the development of chronic dry eye disease, causes permanent accommodative dysfunction, or accelerates myopia progression in children (8, 9, 10).

Second, the field suffers from a lack of standardized diagnostic criteria, validated questionnaires, and objective exposure measures, which drastically reduces the comparability of data across global epidemiological studies (6, 10). Third, the neuro-visual consequences of chronic screen exposure remain poorly understood (6). The complex interaction between sustained near work, high cognitive attention load, autonomic nervous system arousal, sleep deprivation, and subjective visual fatigue requires deeper investigation (10, 11). Finally, robust, long-term randomized controlled trials are needed to evaluate the comparative and cumulative efficacy of behavioral and ergonomic interventions, such as structured blink training, screen modifications, and dietary adjustments, to establish evidence-based guidelines for clinical and public health practice (10).

5. Multi-Level Public Health and Prevention Framework

Mitigating the extensive, life-course burden of DES requires a coordinated, multi-layered preventive response that integrates clinical, ergonomic, behavioral, and public health interventions (3, 6, 10). Because DES is driven by clustered lifestyle behaviors, its management must move beyond passive clinical prescribing to active, multi-level lifestyle modification (6).

5.1 Occupational Health and Workstation Design

Workplaces should implement and enforce ergonomically optimized screen environments to lower physical and visual fatigue (6). Monitors should be positioned at a distance of 50-70 cm and slightly below eye level (15-20 degrees) to reduce the palpebral aperture size, thereby decreasing exposed corneal surface area and minimizing tear evaporation (6, 15). Ergonomic furniture, glare-reduction screens, font enlargement, and workstation lighting must be standard (6). Furthermore, occupational health specialists should integrate scheduled microbreaks into workflow designs, encouraging workers to perform regular blink-awareness exercises to restore tear film stability (6, 16). Periodic visual screenings and symptom surveillance should be routine in high-screen occupations to identify vulnerable individuals early (6, 18).

5.2 Educational Protocols and Academic Digital Hygiene

Schools and universities must adopt formal digital health protocols that recognize screen-related visual strain as a significant learning and health issue (14, 15). Academic schedules should strictly avoid prolonged, uninterrupted digital sessions, integrating mandatory visual rest intervals into virtual curricula (15). Students must be trained in basic screen ergonomics and actively taught the '20-20-20 rule' to allow the ciliary muscle and extraocular convergence systems to relax periodically (16, 17). In pediatric settings, screen time should be restricted and supervised, with a primary emphasis on promoting outdoor activities (8, 11). Outdoor exposure provides natural distance viewing and rich natural light, which are highly protective against myopia progression and promote healthy visual and physical development (8, 9). Academic health services should provide active counseling on DES, particularly during exam periods when visual burdens spike (15, 16).

5.3 Public Health Campaigns and Technological Collaborations

Public health agencies must frame DES as a highly preventable, lifestyle-related ocular disorder (19). Targeted health promotion campaigns should teach the general public about the physiology of blink reduction, correct viewing distances, and symptom recognition, tailoring messages specifically to parents, teachers, employers, and elderly cohorts (16, 17, 19). Furthermore, public health agencies should actively collaborate with software developers and technology manufacturers to integrate default digital wellness features into operating systems (19). These features should include automatic visual break prompts, default blue-light filters, and integrated screen-time dashboards that encourage healthy behavioral modification without restricting the utility of technology (7, 19).

5.4 Summary of Preventive Framework

Table 2 below provides a summary of the most common preventive measures for target populations.

Table 2: Multi-Level Lifestyle-Oriented Preventive Framework for Digital Eye Strain

Preventive Domain	Key Interventions	Lifestyle Medicine Action	Target Population
1. Clinical & Optical (6, 10, 15)	Refractive correction, tear supplementation, active blink-awareness training, dietary omega-3 and lutein supplementation	Restores tear film homeostasis, supports corneal epithelial health, and relieves accommodative overwork	Symptomatic individuals, dry-eye sufferers, older adults, contact lens wearers
2. Ergonomic (6, 15, 19)	Screen height 15-20° below eye level, screen distance 50-70 cm, anti-glare filters, larger font sizing, and ambient humidity control	Decreases the palpebral aperture to reduce tear evaporation, and minimizes ciliary and vergence load	Office employees, software developers, remote workers, academic cohorts
3. Behavioral & Sleep (11, 12, 16, 17)	Enforcing the 20-20-20 rule, screen-time monitoring, nocturnal digital blackouts 1-2 hours before bed, and regular physical activity	Enforces ciliary relaxation, restores natural circadian melatonin secretion, and combats physical sedentary stress	Adolescents, university students, compulsive smartphone users, pediatric populations
4. Institutional & Public Health (8, 9, 15, 19)	Integrating visual breaks into e-learning, restricted pediatric screen time, promoting outdoor activity, and collaborative digital wellness prompts	Establishes community-level support for ocular hygiene and promotes visual and physiological development	Pediatric populations, school children, academic institutions, general public

6. Conclusions

Digital eye strain has emerged as a major modern occupational and public health challenge, driven by the mismatch between human visual biology and the demands of an increasingly screen-dependent lifestyle (1-3). Its pathogenesis is strongly rooted in blink suppression during focused near-visual work, which destabilizes the tear film, increases evaporative stress, and triggers ocular surface symptoms and visual fatigue (6). Although the syndrome is often perceived as a temporary clinical inconvenience, its cumulative burden across pediatric, student, working-age, and geriatric populations is

substantial (8, 11, 13, 14). DES significantly impairs reading efficiency, academic performance, occupational productivity, sleep quality, and overall quality of life, presenting major socio-economic implications for learning and health economics (8, 11, 13, 20).

Transitioning the clinical and public health management of DES from a reactive, symptom-based model to a proactive lifestyle medicine framework is essential (6). This framework must integrate behavioral modifications (such as blink training and digital hygiene), ergonomic workstation adjustments, nutritional support (such as omega-3 and carotenoids), and institutional digital health protocols (8, 10, 15). A coordinated, interdisciplinary response from eye care clinicians, educators, employers, and public health leaders is vital to implement these scalable, low-cost interventions, thereby reducing the rising global burden of DES and protecting human visual and systemic wellness in the digital era (6, 19).

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