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Computer vision syndrome in digital device users

Abstract

Background: Modern lifestyles have been profoundly changed by the quick development of digital technology, which has led to a greater reliance on electronic devices like computers, laptops, tablets, and smartphones for communication, entertainment, professional work, and education. People of all ages are interacting with digital screens for extended periods of time due to the ubiquitous availability of high-speed internet and digital connectivity. Digital devices improve productivity and information accessibility, but their overuse has sparked worries about eye health and comfort. Digital eye strain, another name for Computer eyesight Syndrome (CVS), is a collection of issues with the eyes and eyesight brought on by extended screen time. Some common signs are headaches, dry eyes, eye strain, blurred vision, and pain in the muscles and joints. The rise in CVS cases, especially after the COVID-19 pandemic when more people started working and going to school online, has made it an important public health issue that needs to be addressed.

Methods: This study was executed as a narrative literature review designed to synthesize and evaluate the current research on Computer Vision Syndrome among digital device users. We did a thorough search of the literature using electronic databases like PubMed, Google Scholar, ScienceDirect, and ResearchGate. We found studies that were published between 2016 and 2024 that were relevant by using keywords like "Computer Vision Syndrome," "digital eye strain," "screen time," "visual fatigue," and "smartphone use and eye strain." Boolean operators (AND, OR) were used to make the search more precise. The inclusion criteria encompassed peer-reviewed articles published in English that concentrated on CVS among digital device users, including students, office workers, and smartphone users. Studies published prior to 2016, non-research articles, and studies deficient in methodological specifics were excluded. We systematically gathered and combined data from a number of studies to find patterns related to prevalence, symptoms, risk factors, and ways to avoid them.

Results: The results of this review show that Computer Vision Syndrome is very common among people who use digital devices all over the world. About 50–90% of people have at least one symptom of digital eye strain. The prevalence fluctuates based on factors including age, occupation, duration of screen exposure, and ergonomic practices. Students and office workers are two groups that are most affected by using digital devices for a long time and all the time. Eye strain, blurred vision, dryness, burning sensation, redness, double vision, and light sensitivity are some of the most common eye problems that people report. Headaches, neck pain, shoulder pain, and back pain are some of the most common extra-ocular symptoms. They are often linked to bad posture and poor workstation ergonomics. Some of the main risk factors are spending too much time in front of a screen (more than four to six hours a day), not blinking enough, not being able to see clearly, glare from the screen, bad lighting, and not fixing refractive errors. The COVID-19 pandemic made people spend even more time in front of screens, which led to a noticeable rise in CVS symptoms in both students and professionals. CVS has also been shown to affect how well you can accommodate, the stability of your tear film, your productivity, and your overall quality of life.

Conclusion: Computer Vision Syndrome is becoming a bigger and bigger problem in the digital age because people are spending more time in front of screens and their lifestyles are changing. The condition is very common and can make it hard to see, work, and do everyday things. But there are simple and effective ways to avoid CVS, such as following the 20-20-20 rule, using good ergonomic practices, making sure the lighting is right, getting regular eye exams, and using artificial tears when needed. To lessen the effects of CVS, it is important to raise awareness about healthy digital habits. More research is needed to find out more about the long-term effects of using digital devices for a long time and to come up with more specific ways to stop and treat these effects.

Keywords: computer vision syndrome, digital eye strain, screen time, visual fatigue, smartphone use, ocular health, ergonomics

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Introduction

Digital technology has changed the way people live and do everyday things in a big way. Computers, laptops, tablets, and smartphones are all examples of digital devices that are very important in today's world. People use them a lot for school, work, and fun. People of all ages are spending more time on digital screens because high-speed internet is becoming more common and digital connectivity is getting better. The widespread use of digital devices has made things more efficient, made it easier to find information, and

made it easier for people all over the world to talk to each other. But the growing dependence on digital technology has also made people worry about how it might affect eye health and comfort.

Extended periods of time spent using digital screens have been linked to various visual and eye-related issues. One prevalent condition related to excessive screen time is Computer Vision Syndrome (CVS), which is also referred to as digital eye strain. Computer Vision Syndrome encompasses a range of eye and vision problems that arise from the prolonged use of digital devices like computers, tablets, and smartphones. Those who suffer from Computer Vision Syndrome frequently indicate symptoms such as eye fatigue, blurred vision, dry eyes, headaches, and challenges in maintaining focus on visual tasks after lengthy periods of screen engagement.[1] The intensity of these symptoms can differ based on the length of screen exposure, the visual demands of the activity, and individual eye characteristics.

Several visual challenges arise from digital displays that are not present with traditional printed materials: on digital screens, characters are composed of pixels rather than solid printed letters, which have more clearly defined edges and higher contrast, so the human visual system must work harder to accommodate to maintain clear focus, which can be very fatiguing and uncomfortable with sustained visual effort, especially when viewing digital devices for a long time.[1]

Apart from the physical properties of digital screens, a number of environmental and behavioral factors contribute to the development of CVS: improper viewing distance, poor lighting conditions, glare from digital displays, improper screen positioning, prolonged uninterrupted screen exposure, and reduced blink rate during screen use, which can increase tear evaporation and reduce tear film stability, leading to ocular dryness and irritation.[2]

Another contributing factor to the rise in digital eye strain is the proliferation and prevalence of smartphone use, as smartphones are used for messaging, surfing the internet, social networking, playing games, online learning, and watching videos, all of which are often done at closer viewing distances than computers and laptops, thereby increasing the accommodative and convergence demand on the visual system (the visual effort) and thus potentially leading to symptoms of eye strain and visual fatigue.[3]

The increasing integration of digital devices into both professional and educational settings has also contributed to the rising prevalence of Computer Vision Syndrome. Many occupations now require employees to work on computers for extended periods of time. Office workers, programmers, designers, and other professionals often spend several hours each day performing visually demanding tasks on digital screens. Similarly, students frequently rely on laptops, tablets, and smartphones for studying, completing assignments, attending virtual lectures, and accessing educational resources. As a result, prolonged screen exposure has become common among both adults and younger populations.

The shift to online learning, remote employment, and virtual interactions during the global COVID-19 pandemic also sped up the adoption of digital devices and resulted in increased daily screen time for adults and children, with some reports of an uptick in complaints about digital eye strain and visual discomfort among those who use digital devices.[4]

Given the widespread use of digital devices, Computer Vision Syndrome has become a significant public health issue; although it is not an actual eye disease, CVS can cause considerable discomfort, reduce productivity, and diminish the quality of life for those who suffer from it. Constant visual discomfort can lead to decreased work performance, distraction, and difficulty with tasks that require visual acuity, and as the prevalence of CVS among students and workers continues to rise, it is crucial that more people are aware of the visual impacts of long-term screen use.

In order to promote ocular health in the digital age, it is crucial to comprehend the prevalence, symptoms, risk factors, and preventive measures related to Computer Vision Syndrome. Healthcare practitioners can create effective strategies to lessen visual discomfort and enhance visual performance among digital device users by identifying the factors that lead to digital eye strain. People may adopt better digital device usage habits and preventive measures that support long-term visual health if they are more aware of CVS and the risk factors that are associated with it.

Literature review

Computer Vision Syndrome (CVS), also referred to as digital eye strain, has become a significant concern in recent years due to the widespread use of digital devices. Several studies conducted globally have highlighted its increasing prevalence and associated risk factors.

A study by Rosenfield.,[1] emphasized that prolonged exposure to digital screens leads to visual discomfort due to reduced blink rate and increased accommodative demand. Similarly, Sheppard and Wolffsohn.,[2] reported that digital device users frequently experience symptoms such as dryness, eye strain, and headaches, primarily due to tear film instability and poor visual ergonomics.

Research conducted among university students has shown a high prevalence of CVS. Mowatt et al.,[5] found that over 70% of students reported at least one symptom of digital eye strain, with extended screen time being the most significant contributing factor. Likewise, Logaraj et al. (2014) (still widely cited in later reviews) and more recent studies like Altalhi et al.,[6] confirmed that students using digital devices for more than 4–6 hours daily are at a significantly higher risk of developing CVS.

During the COVID-19 pandemic, screen time increased dramatically due to online education and remote work. Bahkir and Grandee.,[7] observed a marked rise in CVS symptoms among the general population during lockdown periods. Supporting this, Alabdulkader (2021) reported increased visual fatigue, dryness, and headaches among students engaged in prolonged online learning.

Occupational exposure has also been extensively studied. Agarwal et al.,[8] found that office workers using computers continuously reported higher rates of eye strain and musculoskeletal discomfort. Similarly, Dessie et al.,[9] conducted a study among bank workers and reported a CVS prevalence of over 68%, linking it to poor ergonomic practices and long working hours.

Several studies have explored risk factors associated with CVS. Ranasinghe et al.,[10] identified improper viewing distance, glare, poor lighting, and uncorrected refractive errors as major contributors. In addition, reduced blink rate during screen use has been consistently highlighted as a key factor leading to dry eye symptoms.[11]

Preventive strategies have also been discussed in the literature. The 20-20-20 rule, proper screen positioning, regular breaks, and use of artificial tears have been recommended to reduce.[12] Furthermore, Coles-Brennan et al.,[13] emphasized the importance of workplace ergonomic interventions and regular eye examinations in minimizing CVS-related discomfort.

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Recent studies have also examined the impact of CVS on productivity and quality of life. Seguí et al.,[14] reported that individuals with CVS experienced reduced work efficiency and increased fatigue. Additionally, Ganne et al.,[4] highlighted that prolonged digital device usage not only affects ocular health but also contributes to psychological stress and decreased overall well-being.

Overall, the literature consistently demonstrates that CVS is highly prevalent among digital device users, with multifactorial causes including behavioural, environmental, and physiological factors. The increasing dependence on digital technology underscores the need for greater awareness and preventive strategies.

Methodology

Study design

In order to summarize and analyse recent research on Computer Vision Syndrome among users of digital devices, this study was carried out as a narrative literature review. The review's main objective is to determine the frequency, signs, risk factors, and preventative measures of digital eye strain that have been documented in current research.

Search strategy

To find pertinent research studies, a thorough literature search was conducted using a number of electronic databases. The following databases were utilized for the literature search.

a) PubMed

b) Google Scholar

c) ScienceDirect

d) ResearchGate

The search was conducted using combinations of keywords such as:

A. Computer Vision Syndrome

B. Digital eye strain

C. Screen time

D. Digital device users

E. Smartphone use and eye strain

F. Visual fatigue

Boolean operators such as **AND** and **OR** were applied to refine the search and retrieve relevant studies.

Inclusion criteria

Studies were included in this review based on the following criteria:

a. Articles which were published between 2016 and 2024

b. Studies those investigating Computer Vision Syndrome or digital eye strain

c. Studies involving digital device users like students, office workers, or smartphone users

d. Articles those are published in peer-reviewed journals

e. Articles written in English language

Exclusion criteria

The following studies were excluded from the review:

- Articles published before 2016
- Studies those are not related to digital device use
- Conference abstracts, editorials, and opinion articles
- Studies with insufficient methodological information

Data extraction and analysis

Relevant data was methodically extracted from chosen studies. The author's name, the year of publication, the study population, the study design, and the main conclusions about computer vision syndrome were among the extracted data. In order to find common trends regarding the prevalence, symptoms, and risk factors associated with digital eye strain, the results from various studies were compared and synthesized.

Prevalence of computer vision syndrome

People who use digital devices for extended periods of time frequently report having Computer Vision Syndrome. Depending on variables like age, occupation, length of screen time, and ergonomic habits, the prevalence of CVS varies among populations.

Global prevalence

According to recent research, a significant percentage of people who use digital devices have Computer Vision Syndrome symptoms. Computer Vision Syndrome is becoming more commonplace worldwide as a result of people's increased reliance on digital devices for work, education, and entertainment.[15] According to a systematic review on digital eye strain, between 50 and 90 percent of people who use digital devices have at least one Computer Vision Syndrome symptom.[2] Variations in study design, population characteristics, and definitions of CVS may be responsible for the large variation in prevalence. High rates of digital eye strain among computer users have been repeatedly shown by studies carried out in various nations. The prevalence of CVS is rising globally as a result of increased reliance on digital technology in homes, businesses, and educational institutions.

Additionally, because of remote work and online learning, the COVID-19 pandemic caused a sharp rise in the use of digital devices. Studies carried out during the pandemic revealed a notable increase in screen time among professionals and students, which was linked to a higher frequency of symptoms of digital eye strain.[4] These results demonstrate the growing prevalence of Computer Vision Syndrome in today's digital world. According to a systematic review, Computer Vision Syndrome affects about 69% of people, suggesting that it is a common condition linked to extended use of digital screens.[16]

Prevalence among computer users (office workers)

One of the groups most impacted by Computer Vision Syndrome is office workers who use computers for extended periods of time. Data entry, document preparation, programming, and online communication are just a few of the many professional jobs that necessitate constant computer use. According to a study done on computer users, many of them had headaches, dry eyes, blurred vision, and other signs of digital eye strain.[9] According to the study, people who used computers for longer periods of time were more likely to have visual discomfort than people who used them for shorter periods of time. In a similar vein, a different study found that computer users who worked longer than six hours a day were much more likely to experience Computer Vision Syndrome symptoms.

Long-term computer screen use raises visual demands and can cause accommodative fatigue and eye strain.[1] Computer users may

develop CVS as a result of poor ergonomics in office settings. Digital eye strain symptoms can arise as a result of factors like glare from computer screens, incorrect screen height, and improper viewing distance.[2]

Digital eye strain symptoms were considerably more common in people who used computers for more than six hours a day than in people who used them for shorter periods of time, according to research done on computer users.[9] According to these results, office workers who use computers a lot are at a higher risk of developing Computer Vision Syndrome.

Prevalence among students

Due to the widespread use of digital devices for both educational and recreational purposes, students are among the most impacted groups. For social interaction, research, assignments, and online learning, university students often rely on computers and smartphones. During these activities, prolonged screen time raises the possibility of developing visual fatigue. According to a study done on college students, most of the participants had symptoms of Computer Vision Syndrome, such as headaches, eye strain, and blurred vision.[3] Similarly, research done during the COVID-19 pandemic revealed that students' daily screen time increased dramatically as a result of online learning, which raised the prevalence of digital eye strain.[17]

Due to their increased use of smartphones and tablets for entertainment and educational purposes, children and teenagers have also been reported to exhibit signs of digital eye strain. According to this cross-sectional study, health science students had a high prevalence of CVS, which frequently manifests as headaches, blurred vision, and eye strain.[6]

According to a university-based study, extended use of digital devices and inadequate ergonomic practices are the main causes of computer vision syndrome, which is very common among medical students.18

Students engaged in extended online learning were found to have a high prevalence of Computer Vision Syndrome symptoms.[19]

Digital eye strain symptoms were considerably more common in people who used computers for more than six hours a day than in people who used them for shorter periods of time, according to research done on computer users.[9]

Symptoms of computer vision syndrome

Computer Vision Syndrome is characterized by multiple of ocular and extra-ocular symptoms that happens during or after prolonged digital device use.

Ocular symptoms

Ocular symptoms are the most frequently reported manifestations of Computer Vision Syndrome.

Common ocular symptoms include:

a. Eye strain

b. Blurred vision

c. Dry eyes

d. Burning sensation

e. Eye redness

f. Double vision

g. Sensitivity to light

The feeling of fatigue or discomfort in the eyes following extended visual tasks is commonly referred to as eye strain. Continuous use of digital screens raises the eyes' accommodative demand, which can cause visual fatigue.[1]

Temporary accommodative dysfunction linked to extended near work may cause blurred vision. After prolonged screen time, users may find it difficult to stay focused. Digital device users also frequently experience dry eye symptoms. According to studies, people who use digital screens blink less frequently, which increases tear evaporation and causes dry eyes.[2]

Extra-ocular symptoms

In addition to ocular complaints, Computer Vision Syndrome may also cause several extra symptoms.

These include:

A. Headache

B. Neck pain

C. Shoulder pain

D. Back pain

E. General fatigue

Prolonged sitting and bad posture when using digital devices are frequently linked to these symptoms. Musculoskeletal strain in the neck, shoulders, and back can result from improper workstation ergonomics.

People who spend a lot of time staring at digital screens frequently report having headaches. Digital device users may experience headaches as a result of poor posture and visual strain.

Risk factors for computer vision syndrome

Several other factors contribute to the development of Computer Vision Syndrome among digital device users.

Duration of screen exposure

One of the most significant risk factors for CVS is the length of time spent using digital devices. Visual discomfort is more common in people who use digital devices for extended periods of time. Constant screen time puts more strain on the eyes' accommodative and convergence systems. According to studies, people who use digital devices for more than four to six hours a day are much more likely to experience symptoms of digital eye strain.[3]

Reduced blink rate

By dispersing the tear film throughout the eye's surface, blinking is essential for preserving the health of the ocular surface. A typical blink rate is between fifteen and twenty per minute. However, research indicates that when using a digital screen, the blink rate dramatically drops. Reduced blinking increases tear evaporation and tear film instability, which can exacerbate symptoms of dry eyes and cause discomfort when looking.[1,20]

Poor ergonomic conditions

Improper workstation ergonomics may significantly increase the risk of Computer Vision Syndrome.

Important ergonomic factors are:

a) Incorrect screen height

b) Improper viewing distance

c) Poor lighting conditions

d) Screen glare

e) Inadequate seating posture

These are the factors which may contribute to both visual strain and musculoskeletal discomfort among digital device users.[2,21]

Uncorrected refractive errors

Uncorrected refractive errors can make using digital devices more taxing on the eyes. People who have untreated vision issues have to work harder to stay focused on digital screens. Symptoms like eye strain and blurred vision may be exacerbated by this increased visual demand. When using screens for extended periods of time, appropriate eyewear correction can help lessen visual fatigue and enhance visual comfort.[17]

Effects of computer vision syndrome on visual function

Computer Vision Syndrome may affect several aspects of visual performance.

Accommodation and focusing ability

The accommodative system of the eyes is put under more strain when working close to a digital device for extended periods of time. Constant use of digital screens can cause accommodative fatigue, which can cause momentary blurriness and make it difficult to focus clearly.[1]

Tear film stability

Tear film stability may be affected by a decreased blink rate when using a digital screen. According to Sheppard and Wolffsohn.,[2] tear film instability can have an impact on the ocular surface's optical quality and may be a factor in dry eye symptoms and visual discomfort.

Impact on productivity and quality of life

Daily functioning and productivity may also be impacted by computer vision syndrome. Digital eye strain can make it difficult for students to focus on academic assignments. In a similar vein, visual fatigue and discomfort may reduce the productivity of office workers. Both overall quality of life and professional performance may be adversely affected by persistent visual symptoms.[4]

Prevention and management of computer vision syndrome

Several strategies have been recommended to reduce digital eye strain among digital device users.

The 20-20-20 rule

The 20-20-20 rule is a commonly recommended method for reducing visual fatigue. According to this rule, individuals should take a short break every 20 minutes by looking at distance to an object approximately 20 feet away for at least 20 seconds. This practice helps relax the accommodative system and reduces eye strain during prolonged screen use.

Ergonomic adjustments

Proper workstation ergonomics play an important role in preventing Computer Vision Syndrome.

Recommended ergonomic practices include:

a. Maintaining an appropriate viewing distance from the screen

b. Positioning the screen slightly below eye level

c. Reducing screen glare

d. Ensuring adequate lighting conditions

e. Maintaining proper posture while working

f. These adjustments can significantly reduce visual and musculoskeletal discomfort.[22]

Regular eye examinations

To identify refractive errors and other visual issues that could lead to digital eye strain, routine eye exams are crucial. When it comes to managing visual discomfort during the use of digital devices, optometrists can offer recommendations and appropriate prescriptions for glasses.

Use of artificial tears

Artificial tears may help relieve symptoms of dryness associated with excessive screen exposure. These lubricating eye drops help to maintain tear film stability and reduce the ocular surface irritation. Table 1 show Preventive and Management Strategies for Computer Vision Syndrome (CVS).

Table 1 Preventive and management strategies for computer vision syndrome (CVS)

Strategy	What it targets	Evidence / guidance source
Scheduled breaks (20-20-20 rule)	Reduces continuous accommodative/vergence demand by periodic focal change	Recommended as a practical behavioral rule in reviews and workplace guidance (16)
Ergonomic workstation setup	Improves viewing angle and reduces glare and postural strain	Workplace ergonomics and chair/monitor adjustments emphasized in clinical reviews (17, 11)
Optical correction and aids	Corrects refractive error and reduces accommodative stress	Use of appropriate prescription, task-specific lenses, or computer glasses is advised in reviews (16, 17)
Environmental adjustments	Controls lighting, screen brightness and contrast, and reduces glare	Adjusting ambient light and display settings is recommended in multiple reviews (17, 18)
Regular eye examinations	Detects refractive or binocular problems needing intervention	Annual or periodic visual assessment is recommended for monitoring and individualized solutions (16)
Behavioral measures and education	Reduces total screen time and increases awareness of digital hygiene	Education on breaks, posture, and screen habits is repeatedly advised (16, 18)
Adjunct therapies	Provides symptomatic relief for dry eye or ocular discomfort	Includes lubricating eye drops; some small studies evaluate traditional therapies such as Triphala netratarpan (7)

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Discussion

The present review highlights that Computer Vision Syndrome (CVS) is a highly prevalent condition among digital device users, affecting a significant proportion of students, professionals, and the general population. The findings are consistent with previous studies, which report that approximately 50–90% of individuals using digital screens experience at least one symptom of digital eye strain.[1,2] This wide variation in prevalence may be attributed to differences in study populations, duration of screen exposure, and assessment methods.

The most commonly reported symptoms in this review—including eye strain, dryness, blurred vision, and headaches—are in agreement with earlier research.[5,6] These symptoms are primarily linked to prolonged near work, reduced blink rate, and increased visual demand associated with continuous screen use. The decrease in blink rate during digital device usage contributes significantly to tear film instability, leading to dry eye symptoms.[11]

This review also identified several important risk factors such as prolonged screen time (more than 4–6 hours per day), poor ergonomics, improper lighting, glare, and uncorrected refractive errors. These findings are supported by studies conducted by Ranasinghe et al.,[10] and Dessie et al.,[9] which emphasize the role of environmental and behavioral factors in the development of CVS. Additionally, the association between CVS and musculoskeletal symptoms such as neck, shoulder, and back pain highlights the importance of proper posture and workstation design.

The impact of the COVID-19 pandemic has further intensified the burden of CVS. Increased reliance on digital platforms for education and work has led to prolonged screen exposure, thereby exacerbating visual and extra-ocular symptoms.[7,4] This shift underscores the need for targeted interventions, especially among students and remote workers.

Another important finding is the effect of CVS on productivity and quality of life. Individuals experiencing digital eye strain often report reduced work efficiency, increased fatigue, and decreased concentration levels.14 This indicates that CVS is not only an ocular health issue but also a factor affecting overall well-being and occupational performance.

Preventive strategies play a crucial role in minimizing CVS symptoms. The literature strongly supports the implementation of simple measures such as the 20-20-20 rule, regular breaks, proper screen positioning, and adequate lighting conditions.[12,13] Regular eye examinations and appropriate correction of refractive errors are also essential in reducing visual discomfort.

Despite the growing body of evidence, this review has certain limitations. As a narrative review, it may be subject to selection bias, and variations in study design across included studies may affect the generalizability of findings. Furthermore, there is a need for more longitudinal studies to understand the long-term impact of prolonged digital device usage on ocular health.

Overall, the findings of this review emphasize that CVS is a multifactorial condition influenced by behavioral, environmental, and physiological factors. Increasing awareness and promoting healthy digital practices are essential to reduce its prevalence and impact.

Conclusion

Due to the extensive use of computers, smartphones, and other electronic devices, Computer Vision Syndrome has become a serious visual health issue in the digital age. Students, office workers, and other users of digital devices are highly likely to experience digital eye strain, according to numerous studies. Headaches, musculoskeletal pain, dry eyes, blurred vision, and eye strain are typical symptoms. Computer Vision Syndrome is caused by a number of factors, such as extended screen time, decreased blink rate, inadequate ergonomic settings, and uncorrected refractive errors. Digital eye strain can be lessened by implementing preventive measures like frequent breaks, ergonomic modifications, and regular eye exams. To fully comprehend the long-term effects of digital device use on ocular health and visual performance, more research is required.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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