ISSN: 3106-0668
e-ISSN: 3104-4700

JOURNAL OF MEDICINE-24

JOURNAL OF
MEDICINE–24

Volume: 2 Issue: 2

2025

International Indices
ISSN: 3106-0668
e-ISSN: 3104-4700
DOI: 10.36719

ISSN: 3106-0668
e-ISSN: 3104-4700

https://doi.org/10.36719/3104-4700/3/4-11

Hasanboy Khamdamov
Fergana Institute of Public Health
https://orcid.org/0009-0006-9148-497X
hasanboyxamdamov7@gmail.com

Clinical and Functional Evaluation of the Effectiveness of Dacryocystorhinostomy in Dry Eye Syndrome

Abstract

This study evaluated the clinical and functional effectiveness of dacryocystorhinostomy (DCR) in patients with dry eye syndrome (DES). One hundred patients with DES who underwent DCR received comprehensive ophthalmological examination before and after surgery, including tear break-up time (Norn test), Schirmer I test, DES severity grading, subjective symptom scores, and conjunctival hyperemia assessment. After DCR, statistically significant improvements were observed across all parameters ($p < .001$): tear film stability increased by 86% (Norn test: 5.9 ± 0.9 to 11.0 ± 1.5 s), tear secretion doubled (Schirmer I: 6.9 ± 1.0 to 13.8 ± 1.8 mm), DES severity decreased by 46%, subjective complaints decreased by 79%, and conjunctival hyperemia decreased by 78%. DCR significantly improves tear film stability, tear production, and ocular surface condition in patients with DES. Restoration of lacrimal drainage positively influences tear system function and should be considered an integral component of comprehensive DES management.

Keywords: *dry eye syndrome, dacryocystorhinostomy, tear film stability, Schirmer test, Norn test, nasolacrimal duct obstruction, ocular surface*

Introduction

Dry eye disease (DED), also referred to as dry eye syndrome (DES), is one of the most prevalent and clinically significant conditions in modern ophthalmology. According to the Tear Film and Ocular Surface Society Dry Eye Workshop II (TFOS DEWS II), dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities are etiological factors (Craig et al., 2017a). The recently updated TFOS DEWS III report further refined this definition, emphasizing that dry eye is a disease entity rather than a syndrome, with clearly identifiable diagnostic features and disease progression (Craig et al., 2025).

The prevalence of DED varies considerably depending on diagnostic criteria, population characteristics, and geographic region. Population-based estimates utilizing symptom-based criteria report prevalence rates ranging from 5% to 50%, while studies relying on clinical signs alone have documented rates as high as 75% in certain cohorts (Stapleton et al., 2017). Conservative estimates suggest that 10–20% of the population over 40 years of age experience moderate to severe symptoms and/or seek treatment for DED (Britten-Jones et al., 2024). There is an increasing trend in prevalence among younger adults attributable to contact lens wear, prolonged digital device use, and environmental factors (Craig et al., 2023). The high prevalence, chronic progressive nature, and substantial negative impact on patients' quality of life underscore the clinical and socioeconomic significance of this condition (Almulhim, 2024).

The pathophysiology of DES involves a complex interplay of mechanisms, including tear film instability, hyperosmolarity, inflammation of the ocular surface, epithelial damage to the cornea and conjunctiva, and neurosensory disturbances (Bron et al., 2017).

ISSN: 3106-0668
e-ISSN: 3104-4700

These pathological changes manifest as subjective symptoms—dryness, burning, foreign body sensation, photophobia, and visual instability—as well as objective signs of ocular surface damage, collectively reducing visual function and quality of life (National Library of Medicine, 2024).

Despite significant advances in understanding DES pathogenesis, comprehensive management remains subject to ongoing debate. Conventional treatment strategies primarily focus on conservative approaches, including artificial tear replacement, anti-inflammatory therapy, and management of meibomian gland dysfunction (Jones et al., 2017). However, in a substantial proportion of patients, conservative measures alone prove insufficient, necessitating exploration of additional pathogenetically justified therapeutic modalities (Danchenko et al., 2025).

Of particular relevance is the role of the lacrimal drainage system in the pathogenesis and perpetuation of DES. Nasolacrimal duct obstruction (NLDO) is the most common disorder of the lacrimal system, leading to tear stagnation, altered tear composition, and disruption of tear film homeostasis (Perez et al., 2023). Recent research has demonstrated that patients with primary acquired nasolacrimal duct obstruction (PANDO) exhibit significantly decreased tear film stability, with approximately 29.1% meeting diagnostic criteria for concurrent dry eye disease (Yu et al., 2024). Prolonged stasis of tears disrupts the ocular surface microenvironment by facilitating microbial proliferation and enhancing inflammatory reactions (Wang et al., 2025). Furthermore, obstruction of tear outflow alters tear inflammatory cytokine profiles, contributing to the chronification of ocular surface pathology (Lee & Kim, 2014).

Dacryocystorhinostomy (DCR) is the established surgical treatment for NLDO, with reported anatomical success rates of 90–98.8% and functional success rates of 81.9–95% (Lee et al., 2017; Patel & Malhotra, 2023). The procedure creates a functional pathway from the canaliculi into the nasal cavity, bypassing the obstructed nasolacrimal duct and restoring physiological tear drainage (Choe et al., 2026). While DCR is primarily indicated for epiphora relief, emerging evidence suggests that restoration of lacrimal drainage may also positively influence tear film dynamics and ocular surface health (Jin et al., 2022). However, data regarding the specific effects of DCR on DES remain limited, and some studies have reported the emergence or exacerbation of dry eye symptoms following successful DCR in 15–27.3% of patients (Kang et al., 2021; Kim et al., 2023).

Given this ambiguity, there is a clear need for systematic clinical and functional evaluation of the effects of DCR on DES parameters. The present study was designed to quantitatively and qualitatively assess the impact of dacryocystorhinostomy on the principal clinical and functional indicators of dry eye syndrome.

Methods

Study Design and Participants

This prospective interventional study included 100 patients diagnosed with dry eye syndrome and concurrent nasolacrimal duct obstruction who underwent dacryocystorhinostomy at the Department of General Surgery, Fergana Institute of Public Health. Comprehensive ophthalmological evaluation was performed in both the preoperative and postoperative periods.

Inclusion criteria encompassed patients with confirmed NLDO requiring DCR who also met diagnostic criteria for DES based on the TFOS DEWS II guidelines (Craig et al., 2017a), defined as the presence of both subjective symptoms and at least one positive objective test (tear break-up time < 10 s and/or Schirmer I test < 10 mm). Patients with secondary causes of lacrimal obstruction (trauma, neoplasm, prior surgery), autoimmune conditions (Sjögren's syndrome), active ocular infection, history of refractive surgery, or concurrent use of topical medications known to affect tear production were excluded.

Measures

The clinical and functional evaluation protocol included the following standardized assessments performed preoperatively and at the designated postoperative follow-up interval. Tear film stability was assessed using the Norn test (fluorescein tear break-up time [TBUT], measured in seconds), with values below 10 s considered indicative of tear film instability (Bron et al., 2003). Tear production

ISSN: 3106-0668
e-ISSN: 3104-4700

was assessed using the Schirmer I test without anesthesia, measured in millimeters of wetting after 5 minutes, with values below 10 mm indicating aqueous tear deficiency (Lemp et al., 2011). DES severity was graded on a standardized point scale (0–4) based on the totality of clinical and functional signs, incorporating elements from the TFOS DEWS II severity classification (Craig et al., 2017a). Subjective symptoms (burning, dryness, foreign body sensation, photophobia) were evaluated using a standardized scoring scale (0–4). Conjunctival condition, including degree of hyperemia, was graded on a standardized point scale (0–4).

Procedure

All patients underwent standard external dacryocystorhinostomy. The procedure involved creation of a bony osteotomy in the lacrimal fossa with anastomosis of the lacrimal sac mucosa to the nasal mucosa, establishing a direct drainage pathway from the canaliculi to the nasal cavity, thereby bypassing the obstructed nasolacrimal duct (Choe et al., 2026). Silicone tube intubation was performed in cases where clinically indicated.

Data Analysis

Statistical processing was performed using variational statistics. Results are presented as mean values ± standard error of the mean (M ± SEM). The significance of differences between preoperative and postoperative parameters was evaluated using paired t-tests. Percentage improvement was calculated as the absolute change divided by the preoperative value, multiplied by 100. Differences were considered statistically significant at $p < .001$.

Results

Statistically significant improvements were observed across all measured parameters following DCR (see Table 1). The results demonstrate consistent, clinically meaningful changes in both objective functional parameters and subjective patient-reported outcomes.

Table 1.
Comparative Clinical and Functional Parameters
Before and After Dacryocystorhinostomy (N = 100)

Parameter	Pre-DCR	Post-DCR	Δ	% Change	P
Norn test (TBUT), s	5.9 ± 0.9	11.0 ± 1.5	+5.1	86	< .001
Schirmer I test, mm	6.9 ± 1.0	13.8 ± 1.8	+6.9	100	< .001
DES severity	2.6 ± 0.5	1.4 ± 0.5	–1.2	46	< .001
Subjective complaints	3.3 ± 0.6	0.7 ± 0.5	–2.6	79	< .001
Conjunctival hyperemia	2.3 ± 0.5	0.5 ± 0.5	–1.8	78	< .001

Note. Values are M ± SEM. DES severity, subjective complaints, and hyperemia scored 0–4. TBUT = tear break-up time; DES = dry eye syndrome. All comparisons: paired t-test, ***$p < .001$.

Tear Film Stability

The Norn test demonstrated a significant increase from a preoperative mean of 5.9 ± 0.9 s to a postoperative mean of 11.0 ± 1.5 s, an 86% improvement ($p < .001$). Postoperative values exceeded the clinically accepted threshold of 10 s for normal tear film stability (Bron et al., 2003), indicating substantial functional restoration.

Tear Production

The Schirmer I test increased from 6.9 ± 1.0 mm to 13.8 ± 1.8 mm, representing a 100% improvement ($p < .001$). Postoperative values exceeded the diagnostic threshold of 10 mm, indicating normalization of tear production.

ISSN: 3106-0668
e-ISSN: 3104-4700

DES Severity and Subjective Complaints

The composite DES severity score decreased from 2.6 ± 0.5 to 1.4 ± 0.5 (46% improvement; $p < .001$), reflecting a transition from moderate-to-severe to mild DES. Subjective complaints decreased from 3.3 ± 0.6 to 0.7 ± 0.5 (79% reduction; $p < .001$), indicating near-complete symptom resolution.

Conjunctival Hyperemia

Conjunctival hyperemia decreased from 2.3 ± 0.5 to 0.5 ± 0.5 (78% reduction; $p < .001$), reflecting marked resolution of ocular surface inflammation.

Discussion

The results of this study demonstrate that dacryocystorhinostomy produces statistically and clinically significant improvements across all assessed parameters of dry eye syndrome, including tear film stability, tear production, disease severity, subjective symptoms, and conjunctival inflammation. These findings support the hypothesis that surgical restoration of lacrimal drainage has a multifaceted positive influence on the tear system and ocular surface in patients with concurrent DES and NLDO.

Tear Film Stability and the Role of Lacrimal Drainage

The 86% improvement in TBUT is of particular clinical significance. The preoperative mean of 5.9 s was well below the 10-s diagnostic threshold established by the TFOS DEWS II (Craig et al., 2017a), confirming significant tear film instability. Postoperatively, the mean of 11.0 s exceeded this threshold, indicating functional restoration. This finding is consistent with the pathophysiological model proposed by Yu et al. (2024), who demonstrated that PANDO patients exhibit significantly decreased tear film stability compared to controls, with non-invasive keratograph break-up time values inversely correlating with the duration of epiphora. The restoration of physiological tear drainage likely reduces tear stagnation, thereby normalizing tear turnover and composition across the lipid, aqueous, and mucin layers.

Furthermore, improvement in tear film stability may be related to changes in tear inflammatory mediators following DCR. Lee and Kim (2014) reported significant alterations in tear cytokine profiles following endoscopic DCR for PANDO, with decreases in pro-inflammatory cytokines known to destabilize the tear film. The reduction in the inflammatory burden on the ocular surface likely contributes to improved tear film integrity.

Restoration of Tear Production

The doubling of Schirmer I test values is a striking finding that warrants detailed interpretation. In the context of NLDO, tear stagnation creates a negative feedback loop whereby chronic ocular surface irritation stimulates reflex tearing, but the stagnant tears fail to adequately hydrate the surface due to altered composition and impaired distribution (Ji et al., 2023). DCR breaks this cycle by restoring normal tear flow dynamics. The normalization of Schirmer values may also reflect a reduction in compensatory reflex tearing secondary to chronic ocular surface irritation.

Park et al. (2019) similarly observed significant changes in tear film lipid layer thickness following silicone tube intubation for NLDO, demonstrating that restoration of lacrimal drainage is associated with improved tear film composition, including the critical lipid layer that retards evaporation. These compositional changes complement the volumetric improvements reflected in the Schirmer test values.

Reduction in DES Severity and Subjective Symptoms

The 46% reduction in DES severity and 79% decrease in subjective complaints collectively demonstrate that DCR improves both objective disease status and patient-perceived outcomes. The magnitude of subjective improvement exceeding objective severity reduction is noteworthy and may reflect the particular sensitivity of symptom perception to changes in tear dynamics. Craig et al. (2017a) emphasized that symptom burden in DES does not always correlate linearly with objective signs, as neurosensory mechanisms modulate symptom perception independently of measurable ocular surface parameters.

ISSN: 3106-0668
e-ISSN: 3104-4700

Kang et al. (2021) investigated the relationship between DCR outcomes and dry eye symptoms, reporting that DES occurred after successful endoscopic DCR in 27.3% of patients who did not have DES preoperatively, suggesting that lacrimal surgery can unmask subclinical dry eye. In contrast, our study population comprised patients with established DES, in whom DCR consistently improved symptoms. This distinction underscores the importance of preoperative DES assessment and patient selection.

Kim et al. (2023) reported that approximately 15% of patients who underwent endoscopic DCR for PANDO combined with pre-existing dry eye developed significant postoperative dry eye symptoms, with shorter duration of preoperative epiphora being a risk factor. These findings highlight the complex interplay between lacrimal drainage restoration and tear film homeostasis.

Anti-Inflammatory Effects of Lacrimal Drainage Restoration

The 78% reduction in conjunctival hyperemia represents a substantial decrease in ocular surface inflammation. Chronic NLDO is associated with persistent low-grade inflammation of the lacrimal sac and surrounding tissues, characterized by inflammatory infiltration, fibrotic changes, and elevated tear cytokine levels (Wang et al., 2025). Stagnation of tear fluid creates a reservoir for bacterial proliferation and inflammatory mediator accumulation (Tucker et al., 1997). Recent single-cell transcriptomic analysis of nasolacrimal duct tissue revealed that immune cells, particularly CD4+ T cells, constitute over 70% of the cellular population in the obstructed duct, driving a CD4+ T cell–MIF–fibroblast pathway that promotes progressive fibrosis and sustained inflammation (Wang et al., 2025). By surgically bypassing the obstructed duct, DCR effectively interrupts this pathological cascade.

These anti-inflammatory effects are further supported by Lee and Kim (2014), who demonstrated significant reductions in tear-borne inflammatory cytokines, including interleukin-1β and tumor necrosis factor-α, following successful endoscopic DCR. The convergence of clinical improvement and biochemical evidence provides robust support for the anti-inflammatory mechanism of DCR in the context of DES.

Comparison With Existing Literature

Our results are broadly consistent with and extend the existing literature. External DCR achieves anatomical success rates of 90–98.8% and functional success rates of 81.9–95% (Lee et al., 2017; Sobel et al., 2019). The present study contributes a novel dimension by demonstrating that DCR benefits extend beyond epiphora relief to encompass measurable DES improvement.

Our findings contrast with studies reporting adverse DES effects after DCR. The discrepancy may be reconciled by considering that in the Kang et al. (2021) and Kim et al. (2023) studies, DES was unmasked in patients without pre-existing dry eye, whereas in our study, patients with established DES benefited from restored tear drainage. This supports the concept that NLDO symptoms can mask underlying dry eye, and DCR may either improve or reveal DES depending on baseline ocular surface status (Yu et al., 2024).

The dacryocystectomy literature provides additional insight. Rossi et al. (2024) found that dacryocystectomy, which eliminates drainage entirely, may benefit patients with severe DES by increasing the lacrimal meniscus. This observation further underscores the complexity of the tear drainage–DES relationship and supports a patient-specific approach to lacrimal surgery.

Clinical Implications

These findings support the integration of DCR into the comprehensive management strategy for patients with concurrent DES and NLDO. The results emphasize the importance of thorough preoperative assessment of dry eye status in all patients presenting with lacrimal obstruction and provide evidence-based justification for considering DCR as a therapeutic intervention with benefits extending beyond epiphora relief. These implications align with the TFOS DEWS II Management and Therapy Report, which emphasized identifying and treating underlying causes of tear film dysfunction (Jones et al., 2017).

Limitations and Future Directions

Several limitations should be acknowledged. The study lacked a control group of patients with NLDO but without DES. The specific postoperative follow-up interval and its duration were not

ISSN: 3106-0668
e-ISSN: 3104-4700

standardized, and longer-term follow-up would be valuable. The study did not incorporate advanced diagnostic measures such as tear osmolarity, meibography, or OSDI scoring. The absence of blinding in symptom assessment introduces potential bias, and the single-center design may limit generalizability.

Future research should address these limitations through multicenter, randomized controlled trials with longer follow-up periods. Incorporation of tear cytokine analysis, tear osmolarity measurements, confocal microscopy of corneal nerves, and validated patient-reported outcome measures such as the OSDI would enhance mechanistic understanding. Comparative studies evaluating external versus endoscopic DCR in the context of DES outcomes would also be clinically valuable.

Conclusion

This study demonstrates that dacryocystorhinostomy produces statistically significant and clinically meaningful improvements across all assessed parameters of dry eye syndrome in patients with concurrent nasolacrimal duct obstruction. Restoration of lacrimal drainage leads to enhanced tear film stability, normalized tear production, reduced disease severity, substantial alleviation of subjective symptoms, and marked resolution of ocular surface inflammation. These findings support DCR as an effective surgical intervention that positively modulates tear system function and ocular surface condition, warranting its inclusion as an integral component of comprehensive DES management in appropriately selected patients.

References

1. Almulhim, A. (2024). Therapeutic targets in the management of dry eye disease associated with Sjögren's syndrome: An updated review of current insights and future perspectives. *Journal of Clinical Medicine, 13*(6), 1777. https://doi.org/10.3390/jcm13061777
2. Britten-Jones, A. C., Wang, M. T. M., Samuels, I., Jennings, C., Stapleton, F., & Craig, J. P. (2024). Epidemiology and risk factors of dry eye disease: Considerations for clinical management. *Medicina, 60*(9), 1458. https://doi.org/10.3390/medicina60091458
3. Bron, A. J., de Paiva, C. S., Chauhan, S. K., Bonini, S., Gabison, E. E., Jain, S., Knop, E., Markoulli, M., Ogawa, Y., Perez, V., Uchino, Y., Yokoi, N., Zoukhri, D., & Sullivan, D. A. (2017). TFOS DEWS II pathophysiology report. *The Ocular Surface, 15*(3), 438–510. https://doi.org/10.1016/j.jtos.2017.05.011
4. Bron, A. J., Evans, V. E., & Smith, J. A. (2003). Grading of corneal and conjunctival staining in the context of other dry eye tests. *Cornea, 22*(7), 640–650. https://doi.org/10.1097/00003226-200310000-00008
5. Choe, C. H., Yen, M. T., & Marcet, M. M. (2026, January 4). *Dacryocystorhinostomy*. EyeWiki, American Academy of Ophthalmology. https://eyewiki.org/Dacryocystorhinostomy
6. Craig, J. P., Alves, M., Wolffsohn, J. S., Downie, L. E., Efron, N., Galor, A., Gomes, J. A. P., Jones, L., Markoulli, M., Stapleton, F., & Willcox, M. D. P. (2023). TFOS lifestyle report executive summary: A lifestyle epidemic—Ocular surface disease. *The Ocular Surface, 30*, 240–253. https://doi.org/10.1016/j.jtos.2023.08.009
7. Craig, J. P., Nichols, K. K., Akpek, E. K., Caffery, B., Dua, H. S., Joo, C.-K., Liu, Z., Nelson, J. D., Nichols, J. J., Tsubota, K., & Stapleton, F. (2017a). TFOS DEWS II definition and classification report. *The Ocular Surface, 15*(3), 276–283. https://doi.org/10.1016/j.jtos.2017.05.008
8. Craig, J. P., Nichols, K. K., Akpek, E. K., et al. (2025). TFOS DEWS III: Diagnostic methodology. *American Journal of Ophthalmology.* https://doi.org/10.1016/S0002-9394(25)00275-2
9. Danchenko, S. V., Odilov, M. Yu., et al. (2025). Differentiated approaches to correction of the ocular surface condition in dry eye syndrome: A literature review. *Clinical Ophthalmology, 25*(2). https://doi.org/10.32364/2311-7729-2025-25-2-5

ISSN: 3106-0668
e-ISSN: 3104-4700

10. Drozodova, E. A., Berdnikova, E. V., & Dashenko, D. M. (2023). Risk factors, clinical features, and indications for treatment of dry eye syndrome in young patients. *Vestnik Oftalmologii*, (6).
11. Ji, J., Ding, X., et al. (2023). *Prevalence of dry eye during the COVID-19 pandemic: A systematic review and meta-analysis.* PubMed. https://pubmed.ncbi.nlm.nih.gov/38091282
12. Jin, Y., Guo, Y., Liu, Y., et al. (2022). Prevalence and risk factors of dry eye symptoms after successful dacryocystorhinostomy for patients with lacrimal passage obstruction. *European Journal of Ophthalmology, 32*, 2662–2669. https://doi.org/10.1177/11206721211069739
13. Jones, L., Downie, L. E., Korb, D., Benitez-Del-Castillo, J. M., Dana, R., Deng, S. X., Dong, P. N., Geerling, G., Hida, R. Y., Liu, Y., Seo, K. Y., Tauber, J., Wakamatsu, T. H., Xu, J., Wolffsohn, J. S., & Craig, J. P. (2017). TFOS DEWS II management and therapy report. *The Ocular Surface, 15*(3), 575–628. https://doi.org/10.1016/j.jtos.2017.05.006
14. Kang, T. S., Cho, J., Kim, J., et al. (2021). Modified ocular surface disease index as a screening criteria for dry eye syndrome presenting after successful dacryocystorhinostomy. *PLoS ONE, 16*(2), e0247168. https://doi.org/10.1371/journal.pone.0247168
15. Kim, M. H., Lee, K., & Chang, M. (2023). Dry eye assessment of patients undergoing endoscopic dacryocystorhinostomy for nasolacrimal duct obstruction combined with dry eye syndrome. *Korean Journal of Ophthalmology, 37*(5), 395–400. https://doi.org/10.3341/kjo.2023.0042
16. Lee, J., & Kim, T. (2014). Changes in cytokines in tears after endoscopic endonasal dacryocystorhinostomy for primary acquired nasolacrimal duct obstruction. *Eye, 28*(5), 600–607. https://doi.org/10.1038/eye.2014.33
17. Lee, M. J., Khwarg, S. I., Kim, N., et al. (2017). Surgical outcomes of external dacryocystorhinostomy and risk factors for functional failure: A 10-year experience. *Eye, 31,* 691–697. https://doi.org/10.1038/eye.2016.308
18. Lemp, M. A., Bron, A. J., Baudouin, C., et al. (2011). Tear osmolarity in the diagnosis and management of dry eye disease. *American Journal of Ophthalmology, 151*(5), 792–798. https://doi.org/10.1016/j.ajo.2010.10.032
19. National Library of Medicine. (2024). *Dry eye syndrome*. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470411
20. Park, J., Kim, J., & Lee, H. (2019). Evaluation of tear film lipid layer thickness measurements obtained using an ocular surface interferometer in nasolacrimal duct obstruction patients. *Korean Journal of Ophthalmology, 33*(1), 76–82. https://doi.org/10.3341/kjo.2018.0081
21. Patel, B. C., & Malhotra, R. (2023). *Dacryocystorhinostomy*. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557851
22. Perez, Y., Patel, B. C., & Mendez, M. D. (2023). *Nasolacrimal duct obstruction*. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK532873
23. Rossi, C., Baillif, S., Lagier, J., et al. (2024). Dacryocystitis: Is dacryocystorhinostomy always the solution? *Journal of Clinical Medicine, 13*(17), 5145. https://doi.org/10.3390/jcm13175145
24. Sobel, R. K., Aakalu, V. K., Wladis, E. J., Bilyk, J. R., Yen, M. T., & Mawn, L. A. (2019). A comparison of endonasal dacryocystorhinostomy and external dacryocystorhinostomy: A report by the American Academy of Ophthalmology. *Ophthalmology, 126*(11), 1580–1585. https://doi.org/10.1016/j.ophtha.2019.06.009
25. Stapleton, F., Alves, M., Bunya, V. Y., et al. (2017). TFOS DEWS II epidemiology report. *The Ocular Surface, 15*(3), 334–365. https://doi.org/10.1016/j.jtos.2017.05.003
26. Tucker, N., Chow, D., Stockl, F., et al. (1997). Clinically suspected primary acquired nasolacrimal duct obstruction: Clinicopathologic review of 150 patients. *Ophthalmology, 104*(11), 1882–1886. https://doi.org/10.1016/s0161-6420(97)30012-8

ISSN: 3106-0668
e-ISSN: 3104-4700

27. Wang, L., Zhang, Y., Li, H., et al. (2025). Cellular and molecular mechanisms of nasolacrimal duct obstruction: New insights into CD4+ T cell-MIF-fibroblast pathways. *Journal of Advanced Research*. https://doi.org/10.1016/j.jare.2025.01.038
28. Yu, X., Wang, K., Hu, Y., Meng, Z., Li, J., Liu, Y., Xiao, L., Chen, M., Li, S., Shen, Y., Chen, R., & Liang, X. (2024). Dry eye and decreased tear film stability in primary acquired nasolacrimal duct obstruction patients. *International Ophthalmology, 44*(1), 277. https://doi.org/10.1007/s10792-024-03204-8

Received: 25.08.2025
Accepted: 15.11.2025

ISSN: 3106-0668
e-ISSN: 3104-4700

https://doi.org/10.36719/3104-4700/3/12-17

Aytan Mutallimzade
Baku State University
PhD student
https://orcid.org/0000-0002-8170-2383
aytanmutallimzada@bsu.edu.az

Pathological Internet Addiction and Psychopathological Symptoms

Abstract

The Internet has become a widely used communication tool today due to its features such as providing access to information in a short time and enabling rapid communication. In addition to the convenience it brings to human life, the way it is used by some users so as to delay daily life activities or negatively affect them has drawn attention to the negative effects of the Internet on human life. Especially over the last 20 years, we have been confronted with various types of addictions such as internet addiction and online gaming addiction, which particularly affect children and young people and are commonly associated with them. Although steps are being taken to address addictions related to internet, online gaming, and social media use collectively referred to as digital addiction there are almost no holistic and systematic interventions in which the family is actively involved in the process. Although the Internet originally emerged for the purpose of information sharing and communication, it has been identified that adolescents and young adults are particularly at risk due to problematic and excessive use of the internet.

In this article, the pathological aspects of internet addiction are explained. The psychopathological symptoms of internet addiction are presented, and scientific studies are analyzed. We hope that the article will contribute to more effective identification of the onset of internet addiction and to its treatment.

Keywords: *internet addiction, pathological internet addiction, psychopathological symptoms, behavioral disorders, neuropsychological changes, personality psychology*

Introduction

Relevance and aim of the study

The relevance of studying internet addiction in adolescence is determined by the rapid growth of digital technologies and their deep integration into the everyday life of modern society. Adolescence is a critical stage of psychological and personality development, during which basic behavioral patterns, mechanisms of emotional regulation, and social interaction are formed. Under conditions of constant and uncontrolled access to the internet, adolescents face an increased risk of developing maladaptive forms of behavior, including compulsive and pathological internet use, which may negatively affect their psychological well-being, academic performance, and interpersonal relationships.

The aim of this study is to generalize contemporary scientific views on internet addiction among adolescents, to analyze its psychological and psychopathological manifestations, and to identify the main risk factors and consequences of this phenomenon for mental and personal development during adolescence.

Events of the adolescent period have a strong influence on human development and may determine attitudes and behavior later in life. During adolescence, the risk of emotional crises is increased, often accompanied by mood changes and periods of anxiety-depressive behavior, with which some adolescents attempt to cope through withdrawal into themselves, avoidance of extensive social contacts, aggressive reactions, and addictive behavior. Adolescents during this period are extremely vulnerable and sensitive, and the internet may attract them as a form of emotional release. Over time, this can lead to addiction (Shaffer et al., 2000).

ISSN: 3106-0668
e-ISSN: 3104-4700

Internet addiction is a behavioral problem that has gained increasing scientific recognition over the past decade, and some researchers argue that it is an "epidemic of the 21st century" (Pies, 2009). Internet addiction is a complex area of study, given the lack of consensus regarding its definition, reported symptoms, diagnosis, and etiology. Indeed, it has not been established whether it can properly be called an addiction (Widyanto & Griffiths, 2006).

From the perspective of classical psychology and psychiatry, internet addiction is a relatively new phenomenon (Griffiths, 2000). The literature uses interchangeable terms such as "compulsive internet use," "problematic internet use," "pathological internet use" and "internet addiction.". Psychologist Mark Griffiths, one of the most widely recognized authorities in the field of addictive behavior, is the author of the most frequently cited definition. Internet addiction is a non-chemical behavioral addiction that involves human–machine interaction (computer and internet) (Beard, 2005). At the same time, the World Health Organization (WHO)and the American Psychiatric Association (APA) do not recognize internet addiction as a disorder, with the exception of Internet Gaming Disorder (IGD) in the Diagnostic and Statistical Manual of Mental Disorders (APA, 2022).

Methods

In the study of internet addiction in adolescence, modern research employs comprehensive methodological approaches. The most commonly used methods include clinical-psychological interviews, standardized psychodiagnostic questionnaires (such as K. Young's Internet Addiction Test and scales of problematic internet use), as well as observation and self-report methods. In a number of studies, neurobiological methods are applied, including functional magnetic resonance imaging (fMRI), which allows researchers to examine the functional characteristics of brain networks. In addition, correlational, comparative, and longitudinal research designs are used to identify relationships between internet-addictive behavior, emotional disturbances, and socio-demographic characteristics of adolescents.

Compulsive internet use, problematic internet use and pathological internet use

Compulsive Internet Use (CIU) refers to an inadequate relationship with the tool, including loss of control over use, use for mood modification, and withdrawal symptoms (Anderson et al., 2017). Problematic Internet Use (PIU) is addictive behavior and may include excessive or poorly controlled preoccupations, urges, or behaviors related to computer use and Internet access that lead to impairment or distress (Aboujaoude, 2010). Some researchers further develop this definition, suggesting that PIU is a behavioral version of a substance use disorder while others suggest that it is either an impulse control disorder or a subtype of obsessive-compulsive disorder? although empirical evidence for these classifications is lacking (Tereshchenko & Kasparov, 2019).

The term "pathological internet use" duplicates the definition of problematic internet use (PIU); however, conceptually it is modeled as an impulse control disorder and classified as a taxonomy of behavioral addiction related in nature to pathological gambling (Block, 2008). Pathological Internet use includes the following criteria of addictive behavior: uncontrolled Internet surfing, online gambling, and dependence on virtual interpersonal relationships.

A study conducted by researchers from the University College London (UCL) shows that brain changes have been identified in adolescents with internet addiction that may lead to additional addictive behaviors and tendencies. In the article published in the journal PLOS Mental Health, the researchers reviewed 12 studies involving 237 young people aged 10–19 who had been diagnosed with internet addiction between 2013 and 2023. Internet addiction is defined as an individual's inability to resist internet use, resulting in negative effects on psychological health as well as social, academic, and professional life. In the studies, functional magnetic resonance imaging (fMRI) was used to examine how different brain regions interact with each other in participants with internet addiction. Brain activity was examined both during rest and while completing a task. The effects of internet addiction were observed across multiple neural networks. In brain regions that are activated during rest, there was a mixture of increased and decreased activity. In brain regions associated with active thinking, an overall decrease in functional connectivity was observed. The lead author of the

ISSN: 3106-0668
e-ISSN: 3104-4700

study, master's student Max Chang states: "Adolescence is a critical developmental stage during which individuals undergo significant changes in biology, cognition, and personality. During this period, the brain is highly sensitive to impulses related to internet addiction. The findings of our study indicate that this may lead to negative behavioral and developmental changes in adolescent individuals. For example, they may have difficulty maintaining relationships and social activities, may lie about their online activities, or may experience irregular sleep patterns" (Shaw & Black 2008).

With smartphones and laptops becoming more accessible, internet addiction has become a growing global problem. Previous studies have shown that people in the United Kingdom spend more than 24 hours online each week and that more than half of survey respondents are addicted to the internet. The senior author of the study, Irene Lee from the UCL Great Ormond Street Institute of Child Health, addresses the issue as follows: There is no doubt that the internet has certain advantages. However, it becomes a problem when it starts to affect our daily lives. We advise young people to set reasonable time limits for daily internet use and to be aware of the psychological and social effects of spending excessive time online.

Clinicians may recommend treatments targeting specific brain regions or psychotherapy or family therapy aimed at the core symptoms of internet addiction. More importantly, parental education about internet addiction may be another way to prevent addiction from a public health perspective. Parents who are aware of the early signs and onset of internet addiction will be able to address screen time and impulsivity more effectively and minimize risk factors associated with internet addiction. The use of fMRI scans to investigate internet addiction is currently limited, and studies involve small adolescent samples. In addition, participants were predominantly selected from Asian countries. Future research should also include findings from Western samples in order to provide more comprehensive information about treatment interventions.

Internet addiction, in the view of K.Young, is a multidimensional phenomenon that includes:

– manifestations of escapism — escape into virtual reality by individuals with low self-esteem, anxiety, a tendency toward depression, feelings of insecurity, loneliness, or lack of understanding by close ones, burdened by their work, studies, or social environment;

– novelty seeking; a desire for constant sensory stimulation;

– emotional attachment — the opportunity to express oneself, to be empathically understood and accepted, to relieve acute emotional distress related to real-life difficulties, and to receive support and approval;

– pleasure from feeling like a 'virtuoso' in the use of computers and specialized search or communication programs" (Young, 1998).

Psychopathological symptoms of internet addiction

R. Davis proposed a cognitive-behavioral model of pathological Internet use. He identified two forms of internet addiction, which he designated as specific pathological internet use and generalized pathological internet use (Davis, 2001). Thus, all the analyzed definitions are similar and reveal the concept of internet addiction through generalized features (psychopathological symptoms) (Young, 2000).

Psychopathological symptoms of internet addiction include:

– salience (the respondent is likely to feel preoccupied with the Internet, hide their behavior from others, and may demonstrate a loss of interest in other activities and/or relationships in favor of spending more solitary time online);

– excessive use (the respondent exhibits excessive online behavior and compulsive use and periodically cannot control the amount of time spent online, which they may conceal from others);

– neglect of work (academic or work performance and productivity are likely to be compromised due to the amount of time spent on the Internet);

– anticipation (the respondent is likely to think about being online when not at the computer and feels a need to use the Internet when offline);

– loss of control (the respondent finds it difficult to manage their time online and often remains online longer than intended).

ISSN: 3106-0668
e-ISSN: 3104-4700

In recent years, many studies have been conducted in different countries on the prevalence of internet addiction and the socio-demographic characteristics of this phenomenon. Some studies are longitudinal or comparative and include multiple samples. Thus, Kibitov A. O., Trusova A. V., and Egorov A. Yu., in the article internet addiction: Clinical, biological, genetic, and psychological aspects, note: "Overall, neurobiological studies of internet addiction show similarities in its neural mechanisms with substance use disorders. Nevertheless, many unclear issues remain related to the description of precise socio-psychological as well as medico-biological patterns of this disorder, which would allow the determination of effective methods for its therapy" (Kibitov et al., 2019).

A consensus of opinions among researchers, both in Russia and abroad, has not yet been identified. In this regard, the following points expressed by Kibitov A. O. et al. appear important- First, internet addiction is detected predominantly among the younger segment of the population - older adolescents and young adults. It is generally accepted that a risk factor for the development of internet addiction is specific features of central nervous system functioning that have a high level of genetic control and manifest as a distinctive psychological pattern. With the possibility of unlimited Internet use, individuals endowed with such features quickly transition to painful and pathological use – forming internet addiction as a disease.

Second, unlike chemical addictions (alcohol or drug dependence), there are no possibilities for legislative regulation or restriction of Internet access for the younger population. The strategy of reducing the supply of psychoactive substances, successfully used in state anti-alcohol and anti-drug policies, is not applicable in the case of internet addiction. This fact gives maximum importance to preventive measures in work with adolescents and young people. It is important to determine which features of the emotional-volitional sphere of adolescents are associated with a tendency toward internet-addictive behavior, as well as to formulate the main directions of preventive and corrective psychological assistance for individuals with identified internet addiction.

Results

The results of numerous national and international studies indicate that internet addiction in adolescence is a multifactorial and heterogeneous phenomenon. Adolescents exhibiting signs of problematic or pathological internet use more frequently demonstrate symptoms of anxiety, depression, emotional instability, social isolation, and low self-esteem. Pronounced impairments in self-control are observed, accompanied by difficulties in regulating the amount of time spent online and a loss of interest in offline activities. Neuropsychological and neuroimaging studies reveal alterations in the functioning of brain networks associated with cognitive control, reward processing, and emotional regulation. Adolescents with internet addiction show reduced functional connectivity in brain regions responsible for executive functions and goal-directed behavior, as well as an imbalance between impulsivity-related systems and control mechanisms.

The social consequences of internet addiction manifest in deteriorating family and interpersonal relationships, decreased academic motivation and performance, and disturbances in sleep–wake patterns. Overall, the findings confirm that internet addiction has a negative impact on adolescents' psychological, social, and cognitive development and may act as a risk factor for the development of other addictive and psychopathological disorders.

Discussion

The discussion of the obtained data leads to the conclusion that internet addiction in adolescence should not be viewed as an isolated behavioral disorder, but rather as a complex psychosocial phenomenon closely associated with individual personality traits, emotional functioning, and social environmental conditions. The absence of a unified diagnostic approach and the lack of official recognition of internet addiction as an independent disorder complicate both clinical diagnosis and the development of effective prevention and intervention strategies. Early prevention aimed at developing self-regulation skills, fostering a critical attitude toward digital content, and maintaining

ISSN: 3106-0668
e-ISSN: 3104-4700

a healthy balance between online and offline activities is of particular importance. In this context, family upbringing, parental psychoeducation, and the involvement of educational institutions play a crucial role. Promising directions for future research include the study of cultural and socio-economic factors of internet addiction, as well as the development and empirical validation of psychotherapeutic and preventive programs adapted to the adolescent population.

The first step that should be taken in cases of pathological internet addiction is to consult a psychologist. The psychologist identifies the factors contributing to internet addiction in the individual and helps resolve them. If there is a severe psychiatric condition, pharmacological treatment may also be required. However, approaches targeting unconscious conflicts and impulse control are generally more effective. Taking internet addiction seriously is, of course, the most important attitude, as it can lead to dangerous and permanent problems if it grows and is left without intervention.

Keeping children and adolescents away from the internet and games can be difficult for families; however, restricting this time without punishing the child will be beneficial for them. When imposing limitations, establishing a healthy relationship with the child without engaging in power struggles is very important at this point. For the treatment of internet addiction, the individual's relationship with technology is examined and the behaviors they exhibit are evaluated. A discussion is held to address the possibility that spending time obsessively with devices such as smartphones, tablets, and computers may be harmful to the individual. A person who becomes aware of the situation may, through the information they acquire, develop the motivation to overcome this addiction. Treatment can be implemented by introducing restrictions and regulations that break this cycle of addiction and by applying therapeutic interventions deemed necessary for the individual.

Some parental control applications may be used in treatment, and the family and the child/adolescent may participate in therapy together. During this process, it is the responsibility of families to display behaviors that serve as positive role models for children and adolescents and to observe whether the child's internet use is harmful. Family education is of great importance. Parents should be enabled to act as role models for their children by using the internet and computers effectively and beneficially. If the family lacks sufficient knowledge about the appropriate use of the internet and other technological materials, counseling should be provided to the family and rules should be taught. In educational institutions, alongside media literacy, instruction should be given on how to use the internet effectively and beneficially.

Individuals who use the internet in a healthy manner integrate their face-to-face lives with their virtual lives; they talk to their real-life family members and friends about their online experiences; they participate in the online environment with their real identities, interests, and skills; they also meet in real life with people they communicate with online; and they maintain relationships with people they know in the real world through e-mail or chat platforms as well.

Conclusion

Internet addiction and related disorders develop slowly and insidiously. Since completely removing the Internet from an individual's life is not possible under today's conditions and since treatment is quite difficult, preventive measures are of great importance. Because internet addiction can be concealed or may not be perceived as a significant problem, in all cases brought to child and adolescent psychiatry clinics, patterns of Internet, mobile phone, tablet, and gaming use should be questioned from early childhood onward, and intervention should be carried out if risk factors are identified. In advanced cases, the prognosis is poor. Pathological Internet use is associated with high levels of emotional loneliness and weak romantic and friendship relationships. In addition, some studies have shown that the Internet can increase individuals' levels of shyness and loneliness by keeping them away from social activities, reduce family relationships, and decrease the size of individuals' local social environments.

Although there are studies conducted in Azerbaijan and other countries on prevalence, risk factors, psychosocial characteristics, epidemiology, and partly neurobiology, the number of studies

ISSN: 3106-0668
e-ISSN: 3104-4700

related to treatment is insufficient. More research is needed on the treatment of technological addictions. If more information can be provided, more sound steps can be taken in determining the etiology and in identifying preventive and therapeutic methods.

References

1. American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders.* American Psychiatric Publishing.
2. Anderson, E. L., Steen, E., & Stavropoulos, V. (2017). Internet use and problematic Internet use: A systematic review of longitudinal research trends in adolescence and emergent adulthood. *International Journal of Adolescence and Youth*, *22*, 430–454.
3. Aboujaoude, E. (2010). Problematic Internet use: An overview. *World Psychiatry*, *9*, 85–90.
4. Beard, K. W. (2005). Internet addiction: A review of current assessment techniques and potential assessment questions. *CyberPsychology & Behavior*, *8*, 7–14.
5. Block, J. J. (2008). Issues for DSM-V: Internet addiction. *American Journal of Psychiatry*, *165*(3), 306–307.
6. Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior, 17*(2), 187–195.
7. Griffiths, M. D. (2000). Does internet and computer "addiction" exist? Some case study evidence. *CyberPsychology & Behavior, 3*(2), 211–218.
8. Kibitov, A. O., Trusova, A. V., & Egorov, A. Yu. (2019). Internet addiction: Clinical, biological, genetic, and psychological aspects. *Voprosy narkologii*, *2*(173), 22–47.
9. Pies, R. (2009). Should DSM-V designate "Internet addiction" a mental disorder? *Psychiatry, 6*, 31–37.
10. Shaffer, H. J., Hall, M. N., & Bilt, J. V. (2000). Computer addiction: A critical analysis. *American Journal of Orthopsychiatry*, *70*, 162–168.
11. Shaw, M., & Black, D. W. (2008). Internet addiction: Definition, assessment, epidemiology, and clinical management. *CNS Drugs*, *22*, 353–365.
12. Tereshchenko, S., & Kasparov, E. (2019). Neurobiological risk factors for the development of internet addiction in adolescents. *Behavioral Sciences*, *9*(6), 62.
13. Widyanto, L., & Griffiths, M. D. (2006). Internet addiction: A critical review. International *Journal of Mental Health and Addiction*, *4*, 31–51.
14. Young, K. S. (2000). Diagnosis – Internet addiction. *World of the Internet*, *2*, 24–29.
15. Young, K. S. (1998). Internet addiction: The emergence of a new clinical disorder. *CyberPsychology & Behavior*, *1*, 237–244.

Received: 13.08.2025
Accepted: 31.11.2025

CONTENTS

Signed: 18.12.2025
Online publication: 24.12.2025
Format: 60/84, 1/8
Stock issuance: 4 p.s..
Order: 139

It has been published on aem.az
Address: Baku city, Matbuat Avenue, 529,
“Azerbaijan” Publishing House, 6th floor
Phone: +994 50 209 59 68
+994 55 209 59 68
e-mail: info@aem.az