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Original Article

Association Between Topical Retinol Use and Contact Lens Intolerance Among Young Adults

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ABSTRACT

Background: Topical retinol is commonly used by young adults for acne, pigmentation, and skin rejuvenation, while contact lens wear depends on a stable tear film and healthy ocular surface. Periocular application of retinol may expose the eyelid margin and tear film to active skincare ingredients, potentially contributing to tear film instability and contact lens discomfort. **Objective:** To assess the association between topical retinol use, contact lens intolerance, tear film stability, and ocular surface symptoms among young adult soft contact lens wearers. **Methods:** This cross-sectional observational study included 80 soft contact lens wearers aged 18–35 years. Participants were classified according to topical retinol exposure and assessed using a structured questionnaire, tear break-up time, Schirmer test, slit-lamp examination, and Ocular Surface Disease Index scoring. The association between retinol use and contact lens intolerance was analyzed using the chi-square test, while correlations between retinol exposure and ocular surface outcomes were assessed using Pearson correlation. **Results:** Contact lens intolerance was reported by 40 of 60 retinol users (66.7%) and 10 of 20 non-users (50.0%). Retinol users showed higher odds of intolerance, although the association was not statistically significant (OR = 2.00, $\chi^2 = 1.78$, $p = 0.182$). Higher retinol-use frequency was associated with lower TBUT in the right eye ($r = -0.35$, $p = 0.001$) and left eye ($r = -0.30$, $p = 0.007$), while longer duration of retinol use correlated with higher OSDI scores ($r = 0.55$, $p < 0.001$). Schirmer values remained within the normal range. **Conclusion:** Topical retinol use, particularly frequent or prolonged exposure, was associated with reduced tear film stability and greater ocular surface symptom burden among young adult contact lens wearers.
Keywords: Topical retinol, contact lens intolerance, tear film stability, TBUT, OSDI, dry eye, ocular surface.

INTRODUCTION

Contact lens wear is widely used among young adults for visual correction, cosmetic preference, and lifestyle convenience, but successful lens wear depends heavily on a stable ocular surface and an intact tear film. The precorneal tear film maintains optical quality, reduces friction between the contact lens and corneal epithelium, supports epithelial integrity, and facilitates comfortable lens movement during blinking. Disruption of this system can result in dryness, burning, redness, foreign body sensation, fluctuating vision, reduced wearing time, and eventual contact lens intolerance. Contact lens-related discomfort is multifactorial, with established contributors including lens material, wearing schedule, environmental exposure, blink patterns, tear film quality, ocular surface inflammation, and meibomian gland function (1,2). Because the lipid layer secreted by the meibomian glands limits tear evaporation, any factor that alters eyelid margin health or lipid secretion may accelerate tear break-up and reduce contact lens comfort (3).

In parallel with contact lens use, topical retinol and other vitamin A-derived skincare products have become common among young adults for acne control, pigmentation, skin texture improvement, and early anti-aging care. Although these products are intended for facial application rather than direct ocular use, they are frequently applied close to the periocular region, where the eyelid skin is thin and anatomically adjacent to the tear film and meibomian gland orifices. Product migration through

rubbing, sweating, blinking, or inadvertent transfer may expose the ocular surface to active cosmetic ingredients. Previous research has suggested that retinoid exposure may influence ocular surface stability, meibomian gland morphology, epithelial turnover, and tear film quality, particularly when exposure occurs near the eyelid margin (4,5). Systemic isotretinoin has been more extensively studied and is known to affect tear film stability and meibomian gland function, but emerging evidence also indicates that topical retinoids may contribute to dry eye symptoms, lid margin inflammation, and reduced ocular surface comfort (6,7).

The biological plausibility of an association between topical retinol use and contact lens intolerance is clinically important. Contact lenses already divide and interact with the tear film, increasing dependence on adequate tear volume, lipid layer integrity, and ocular surface lubrication. If topical retinol contributes to meibomian gland dysfunction, tear film instability, or periocular irritation, contact lens wearers may experience symptoms earlier and more severely than non-wearers. Studies examining cosmetic products and active skincare ingredients have reported associations with ocular discomfort, tear film contamination, reduced tear break-up time, and dissatisfaction with contact lens wear (8,9). Other reports have linked topical dermatological treatments and retinoid-containing products with altered tear film composition, ocular irritation, and dry eye-related symptoms (10,11). These findings suggest that skincare exposure may be an underrecognized modifiable factor in contact lens discomfort, especially among young adults who frequently combine prolonged lens wear, digital screen use, and active facial skincare routines.

Despite this plausible pathway, the available evidence remains limited and fragmented. Much of the existing literature focuses on systemic isotretinoin, general cosmetics, dry eye disease, or meibomian gland dysfunction separately, rather than specifically evaluating topical retinol exposure among contact lens users. Evidence from South Asian and Pakistani populations is particularly scarce, although local patterns of cosmetic use, climate, screen exposure, and contact lens habits may influence ocular surface outcomes. In routine optometric practice, skincare history is not always explored when young contact lens wearers present with dryness, reduced wearing tolerance, or nonspecific irritation. This creates a clinically relevant knowledge gap regarding whether topical retinol use, particularly when applied near the eyes, is associated with measurable tear film instability and patient-reported contact lens intolerance.

Using a PICO framework, the population of interest in the present study comprises young adult soft contact lens wearers aged 18–35 years; the exposure is topical retinol use, including periocular application; the comparison is contact lens wearers without recent topical retinol use; and the outcomes are contact lens intolerance, tear film stability measured by tear break-up time, tear production measured by Schirmer testing, ocular surface symptoms measured by the Ocular Surface Disease Index, and slit-lamp findings. The present study therefore aimed to determine whether topical retinol use is associated with contact lens intolerance and ocular surface disturbance among young adult contact lens wearers. The primary research hypothesis was that topical retinol use is associated with a higher frequency of contact lens intolerance and reduced tear film stability compared with non-use.

MATERIALS AND METHODS

The association between topical retinol use and contact lens intolerance among young adults was evaluated using a cross-sectional observational study design. This design was selected because it allowed simultaneous assessment of topical retinol exposure, contact lens-related symptoms, tear film stability, tear production, and ocular surface findings at a single point in time. The study was conducted in the optometry clinic of Sheikh Zaid Hospital over a three-month data collection period. The target population comprised young adult soft contact lens wearers aged 18–35 years, including both individuals currently using topical retinol-containing products and individuals without recent topical retinol use.

Participants were selected through non-probability convenience sampling from patients and eligible contact lens wearers presenting to the optometry clinic during the study period. Individuals were eligible

for inclusion if they were aged 18–35 years, had been wearing soft contact lenses for at least three months, used contact lenses for at least four days per week, wore lenses for approximately six hours or more per day, and were willing to provide written informed consent and complete the study questionnaire. Participants were classified as topical retinol users if they had applied a retinol-containing topical product at least once weekly during the preceding four weeks. Participants were classified as non-users if they had no recent topical retinol exposure during the defined assessment period. Individuals were excluded if they had a previous diagnosis of dry eye disease, blepharitis, ocular surface disease, active ocular infection or inflammation, history of ocular trauma or surgery within the preceding six months, current systemic retinoid use, use of medications known to affect tear production, or systemic conditions associated with tear film disturbance, including Sjögren's syndrome and poorly controlled diabetes mellitus.

Recruitment began with eligibility screening based on age, contact lens history, ocular history, systemic history, medication use, and topical skincare exposure. Eligible participants were informed about the study purpose, clinical procedures, voluntary participation, confidentiality of responses, and their right to withdraw at any stage without effect on clinical care. Written informed consent was obtained before questionnaire administration or ocular examination. After consent, participants completed a structured pre-assessment questionnaire designed to collect demographic information, occupation status, contact lens type, duration of contact lens use, average daily wearing time, weekly wearing frequency, contact lens-related symptoms, topical retinol product type, frequency of retinol use, duration of retinol use, site of application, and history of irritation after retinol use. Contact lens intolerance was operationally defined as the presence of contact lens-related discomfort symptoms such as dryness, burning, redness, foreign body sensation, itching, blurred vision, or reduced comfort during lens wear sufficient to be reported by the participant during assessment.

Topical retinol exposure was assessed as the main independent variable and was recorded as a categorical variable according to use status, product formulation, frequency of weekly application, duration of use, and area of application. Periocular application was defined as retinol application around or near the eyelids or eye region. Contact lens intolerance was assessed as the main clinical outcome. Tear film stability was measured using tear break-up time, tear production was assessed using the Schirmer test, subjective ocular surface symptoms were measured using the Ocular Surface Disease Index, and ocular surface signs were evaluated through slit-lamp biomicroscopy. Additional clinical variables included visual acuity, conjunctival redness, superficial punctate keratitis, and lid margin abnormalities.

Clinical assessment was performed after completion of the questionnaire. Tear break-up time was measured using fluorescein dye. After fluorescein instillation, participants were instructed to blink naturally, and the interval between the last complete blink and the first appearance of a dry spot on the corneal surface was recorded in seconds using slit-lamp examination with cobalt blue illumination. The test was performed separately for the right and left eyes, and shorter values were interpreted as evidence of reduced tear film stability.

Tear production was assessed using the Schirmer test by placing a standardized filter paper strip in the lower conjunctival fornix for five minutes and recording the length of wetting in millimeters. Slit-lamp examination was then performed to evaluate conjunctival redness, superficial punctate keratitis, lid margin changes, and other observable ocular surface abnormalities. Visual acuity was assessed for both eyes as part of the clinical examination. Subjective symptoms were assessed using the Ocular Surface Disease Index questionnaire, and scores were categorized into normal, mild, moderate, and severe symptom groups according to standard scoring ranges.

To reduce information bias, the same structured questionnaire format and uniform clinical assessment sequence were used for all participants. Eligibility criteria excluded individuals with pre-existing ocular surface disease, recent ocular surgery or trauma, systemic retinoid use, tear-affecting medications, and systemic diseases known to influence tear film stability, thereby reducing the effect of major clinical

confounders. Contact lens-related variables, including lens type, duration of use, and daily wearing time, were recorded because they may influence ocular comfort and tear film stability. Retinol-related variables, including frequency, duration, formulation, and periocular application, were recorded to allow exposure characterization and assessment of dose- or duration-related patterns. Data were checked for completeness before entry, and participant responses were coded using predefined categories to reduce entry variation.

The sample size was calculated using a single population proportion formula with a 95% confidence level, an estimated proportion of 0.05, and a margin of error of 0.05, resulting in an estimated required sample of approximately 80 participants. A final sample of 80 young adult soft contact lens wearers was included for analysis (5). Data were entered and analyzed using SPSS. Categorical variables, including age group, gender, occupation status, lens type, retinol use status, retinol application area, symptom categories, OSDI severity category, and slit-lamp findings, were summarized using frequencies and percentages. Continuous variables, including daily contact lens wearing time, tear break-up time, Schirmer test values, frequency of retinol use, duration of retinol use, and OSDI score, were summarized using mean and standard deviation where appropriate.

The association between topical retinol use and contact lens intolerance was evaluated using the chi-square test of independence because both variables were categorical. Pearson correlation analysis was used to assess the relationship between frequency of retinol use and tear break-up time and between duration of retinol use and OSDI score. Statistical significance was determined using a two-sided p-value threshold of less than 0.05. Where applicable, right-eye and left-eye values were analyzed separately to assess consistency of tear film findings between eyes.

Data were reviewed for missing or incomplete responses before analysis, and incomplete entries were excluded from the relevant variable-specific analysis while retaining complete available data for other analyses. Ethical principles of voluntary participation, informed consent, privacy, confidentiality, and non-maleficence were maintained throughout the study. Data were anonymized before statistical analysis, stored securely, and handled only for research purposes. Standardized assessment procedures, predefined operational definitions, uniform data collection forms, and consistent statistical methods were used to support reproducibility and data integrity.

RESULTS

A total of 80 young adult soft contact lens wearers were included in the analysis. The largest age group was 21–25 years, comprising 34 participants (42.5%), followed by 18–20 years in 20 participants (25.0%), 26–30 years in 18 participants (22.5%), and 31–35 years in 8 participants (10.0%). The sample was predominantly female, with 50 female participants (62.5%), 28 male participants (35.0%), and 2 participants categorized as other gender (2.5%). Half of the participants were students (50.0%), while 34 participants (42.5%) were employed and 6 participants (7.5%) were unemployed. Soft monthly lenses were the most frequently used lens type, reported by 40 participants (50.0%), followed by soft daily lenses in 25 participants (31.3%) and soft weekly lenses in 10 participants (12.5%). The mean daily contact lens wearing time was 8.0 ± 1.5 hours, with 40 participants (50.0%) wearing lenses for 7–9 hours daily and 25 participants (31.3%) wearing lenses for 10 or more hours daily.

Table 1. Demographic Characteristics and Contact Lens Wearing Pattern of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age group	18–20 years	20	25.0
	21–25 years	34	42.5
	26–30 years	18	22.5
	31–35 years	8	10.0
Gender	Male	28	35.0
	Female	50	62.5
	Other	2	2.5
Occupation/status	Student	40	50.0

Variable	Category	Frequency (n)	Percentage (%)
	Employed	34	42.5
	Unemployed	6	7.5
Lens type	Soft monthly	40	50.0
	Soft daily	25	31.3
	Soft weekly	10	12.5
	Other	5	6.3
Duration of contact lens use	0–6 months	20	25.0
	6–12 months	30	37.5
	1–3 years	20	25.0
	>3 years	10	12.5
Daily wearing time	4–6 hours	15	18.8
	7–9 hours	40	50.0
	≥10 hours	25	31.3
Mean daily wearing time	Mean ± SD	8.0 ± 1.5 hours	

Topical retinol exposure was reported in 60 participants (75.0%), while 20 participants (25.0%) were classified as non-users. Among retinol users, serum was the most common formulation, reported by 60 participants in the overall sample.

Frequent application was common, with 35 participants (43.8%) reporting use 3–4 times weekly and 30 participants (37.5%) reporting use 5–7 times weekly. Retinol use for 4–6 months was the most frequently reported duration, observed in 40 participants (50.0%). Application near the periocular region was common, with 50 participants (62.5%) applying retinol around the eyes and 10 participants (12.5%) applying it both to the face and periocular region. Irritation after retinol use was reported by 15 participants (18.8%), while 65 participants (81.3%) did not report irritation.

Table 2. Topical Retinol Exposure Characteristics

Variable	Category	Frequency (n)	Percentage (%)
Topical retinol use	Yes	60	75.0
	No	20	25.0
Retinol product type	Serum	60	75.0
	Cream	15	18.8
	Gel/other	5	6.3
Frequency of retinol use	1–2 times/week	10	12.5
	3–4 times/week	35	43.8
	5–7 times/week	30	37.5
	Daily	5	6.3
Duration of retinol use	1–3 months	15	18.8
	4–6 months	40	50.0
	7–12 months	15	18.8
	>1 year	10	12.5
Area of application	Face only	20	25.0
	Periocular/around eyes	50	62.5
	Both face and periocular area	10	12.5
Irritation after retinol use	Yes	15	18.8
	No	65	81.3

Ocular surface symptom assessment showed that 40 participants (50.0%) had normal OSDI scores, while the remaining 40 participants (50.0%) had some degree of ocular surface symptoms. Mild symptoms were present in 25 participants (31.3%), moderate symptoms in 10 participants (12.5%), and severe symptoms in 5 participants (6.3%).

Dryness was the most frequently reported contact lens-related symptom, affecting 35 participants (43.8%), followed by foreign body sensation in 30 participants (37.5%) and burning in 20 participants (25.0%). Redness was reported by 15 participants (18.8%), itching by 10 participants (12.5%), and blurred vision by 5 participants (6.3%).

Clinical assessment showed preserved visual acuity in all participants. Mean TBUT was reduced in both eyes, measuring 6.0 ± 2.1 seconds in the right eye and 6.1 ± 2.0 seconds in the left eye, whereas Schirmer values remained within the normal range, with mean values of 15.0 ± 3.2 mm in the right eye and 14.8 ± 3.5 mm in the left eye. These findings indicate a pattern more consistent with tear film instability than aqueous tear deficiency.

Table 3. Ocular Symptoms and Clinical Findings

Variable	Category / Eye	Frequency (n) or Mean ± SD	Percentage (%)
OSDI category	Normal (0–12)	40	50.0
	Mild (13–22)	25	31.3
	Moderate (23–32)	10	12.5
	Severe (33–100)	5	6.3
Symptoms during contact lens wear	Dryness	35	43.8
	Foreign body sensation	30	37.5
	Burning	20	25.0
	Redness	15	18.8
	Itching	10	12.5
	Blurred vision	5	6.3
Visual acuity	Right eye	80	100.0
	Left eye	80	100.0
Slit-lamp findings	Redness, right eye	15	18.8
	Redness, left eye	10	12.5
	SPK, right eye	10	12.5
	SPK, left eye	8	10.0
	Lid margin finding, right eye	5	6.3
	Lid margin finding, left eye	5	6.3
TBUT	Right eye	6.0 ± 2.1 seconds	
	Left eye	6.1 ± 2.0 seconds	
Schirmer test	Right eye	15.0 ± 3.2 mm	
	Left eye	14.8 ± 3.5 mm	

Contact lens intolerance was reported by 50 of 80 participants (62.5%). Among topical retinol users, 40 of 60 participants (66.7%) reported contact lens intolerance, compared with 10 of 20 non-users (50.0%). The odds of contact lens intolerance were higher among retinol users than non-users, with an odds ratio of 2.00; however, the 95% confidence interval was wide (0.72–5.59). Based on the displayed 2 × 2 distribution, the Pearson chi-square statistic was 1.78 with a p-value of 0.182, and Fisher's exact test showed p = 0.195. This indicates that although intolerance was numerically more frequent among topical retinol users, the categorical association did not reach the conventional threshold for statistical significance in the aggregated 2 × 2 analysis.

Table 4. Association Between Topical Retinol Use and Contact Lens Intolerance

Topical Retinol Use	Contact Lens Intolerance: Yes, n (%)	Contact Lens Intolerance: No, n (%)	Total	Odds Ratio (95% CI)	Pearson χ^2	p-value
Yes	40 (66.7)	20 (33.3)	60	2.00 (0.72–5.59)	1.78	0.182
No	10 (50.0)	10 (50.0)	20	Reference		
Total	50 (62.5)	30 (37.5)	80			

Correlation analysis demonstrated an inverse relationship between frequency of retinol use and tear film stability. Frequency of retinol use was negatively correlated with right-eye TBUT (r = -0.35, 95% CI: -0.53 to -0.14, p = 0.001) and left-eye TBUT (r = -0.30, 95% CI: -0.49 to -0.09, p = 0.007), indicating that more frequent retinol application was associated with shorter tear break-up time. Right-eye and left-eye TBUT were strongly positively correlated with each other (r = 0.80, 95% CI: 0.70 to 0.87, p < 0.001), supporting bilateral consistency in tear film stability measurements. Duration of retinol use showed a positive correlation with OSDI score (r = 0.55, 95% CI: 0.38 to 0.69, p < 0.001), indicating that longer retinol exposure was associated with greater subjective ocular surface symptom severity.

Table 5. Correlation Between Retinol Exposure and Ocular Surface Outcomes

Exposure Variable	Outcome Variable	n	Correlation Coefficient (r)	95% CI	p-value
Frequency of retinol use	TBUT, right eye	80	-0.35	-0.53 to -0.14	0.001
Frequency of retinol use	TBUT, left eye	80	-0.30	-0.49 to -0.09	0.007
TBUT, right eye	TBUT, left eye	80	0.80	0.70 to 0.87	<0.001
Duration of retinol use	OSDI score	80	0.55	0.38 to 0.69	<0.001

Overall, the results show that topical retinol exposure was common in this cohort of young adult contact lens wearers, particularly serum use and periocular application. Half of the participants had abnormal OSDI categories ranging from mild to severe, and the most frequent symptoms were dryness, foreign body sensation, and burning. Clinical measurements showed reduced TBUT with preserved Schirmer values, suggesting that tear film instability rather than reduced tear production was the dominant objective finding. Retinol users had a higher observed frequency of contact lens intolerance than non-

users, while correlation analyses showed clinically meaningful relationships between greater retinol exposure and worse ocular surface indicators, especially reduced TBUT and higher OSDI scores.

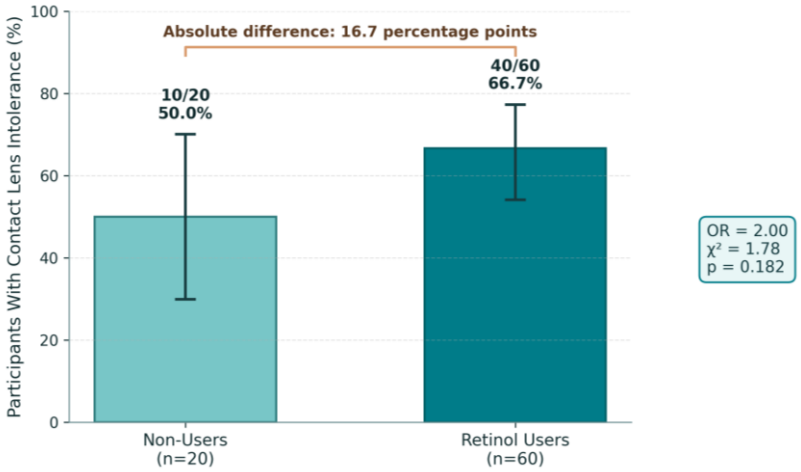

Figure 1. Contact Lens Intolerance by Topical Retinol Exposure

The figure shows that contact lens intolerance was observed in 40 of 60 topical retinol users (66.7%) compared with 10 of 20 non-users (50.0%), giving an absolute difference of 16.7 percentage points. The estimated odds of intolerance were higher among retinol users (OR = 2.00), although the confidence interval pattern and chi-square result indicate that the exposure-outcome difference did not reach statistical significance in the aggregated comparison ($\chi^2 = 1.78$, $p = 0.182$). Clinically, the higher intolerance burden among retinol users suggests a potentially meaningful ocular surface signal, but the overlap in uncertainty supports cautious interpretation.

DISCUSSION

The present study evaluated whether topical retinol use was associated with contact lens intolerance and ocular surface disturbance among young adult soft contact lens wearers. The findings showed that contact lens intolerance was numerically more frequent among topical retinol users than non-users, with intolerance reported by 66.7% of retinol users compared with 50.0% of non-users. Although this difference suggested a clinically relevant trend, the categorical association did not reach statistical significance in the aggregated 2 × 2 comparison, indicating that the observed exposure-outcome difference should be interpreted cautiously. In contrast, correlation analysis demonstrated clearer exposure-related patterns: greater frequency of retinol use was associated with shorter tear break-up time in both eyes, while longer duration of retinol use was associated with higher OSDI scores. These findings suggest that topical retinol exposure may be more strongly reflected in tear film instability and symptom severity than in a simple binary classification of contact lens intolerance.

The inverse association between frequency of retinol use and TBUT is clinically meaningful because tear film stability is central to comfortable contact lens wear. Contact lenses depend on a uniform tear layer to maintain hydration, optical clarity, and smooth interaction with the eyelid during blinking. When TBUT is reduced, the tear film breaks more rapidly over the lens surface, increasing friction, dryness, burning, foreign body sensation, and fluctuating comfort during lens wear. In the present study, mean TBUT values were approximately 6 seconds in both eyes, while Schirmer values remained within the normal range. This pattern indicates that symptoms were more consistent with evaporative or stability-related tear dysfunction rather than reduced aqueous tear production. Similar mechanisms have been described in contact lens-related discomfort, where tear film instability and lipid layer disturbance play a greater role than tear volume alone (12).

The biological plausibility of these findings is supported by the anatomical proximity between periocular skincare application and the eyelid margin. Retinol-containing products are not intended for direct

ocular exposure, but application near the eyes may allow migration toward the tear film through blinking, sweating, eye rubbing, or inadvertent spread during skincare routines. The eyelid margin contains the meibomian gland orifices, which supply the lipid layer of the tear film. Disruption of this lipid layer can accelerate evaporation and shorten TBUT, thereby increasing contact lens discomfort. Previous work on retinoid exposure has suggested that vitamin A derivatives may affect meibomian gland structure, epithelial turnover, and ocular surface homeostasis, providing a plausible pathway through which frequent topical retinol use could contribute to tear film instability (13,14).

The symptom profile observed in this study further supports the relevance of tear film instability. Dryness was the most common symptom, followed by foreign body sensation and burning, which are typical complaints in contact lens discomfort and ocular surface irritation. These symptoms are also consistent with an unstable tear film rather than isolated aqueous deficiency, particularly when Schirmer results remain normal. The OSDI distribution showed that half of the participants had at least mild ocular surface symptoms, indicating that a substantial proportion of young contact lens wearers experienced measurable symptom burden despite preserved visual acuity. The positive correlation between duration of retinol use and OSDI score suggests that prolonged exposure may be associated with cumulative ocular surface discomfort, especially when retinol is applied near the periocular region.

The lack of statistical significance in the binary association between topical retinol use and contact lens intolerance does not exclude a clinically relevant relationship. The exposed and non-exposed groups were unequal in size, and the non-user group was relatively small, which may have limited statistical power to detect differences in intolerance prevalence. Moreover, contact lens intolerance is a multifactorial outcome influenced by lens type, wearing duration, replacement schedule, screen exposure, environmental dryness, blink rate, cosmetics use, hygiene practices, and baseline ocular surface condition. A binary yes/no outcome may therefore be less sensitive than continuous clinical indicators such as TBUT or OSDI score. This may explain why exposure-frequency and exposure-duration relationships were more informative than the categorical comparison alone.

The predominance of female participants and the high frequency of periocular retinol application are also relevant to interpretation. Young adults who use cosmetic and dermatologic products may combine multiple exposures, including moisturizers, sunscreens, makeup, cleansers, and active ingredients such as retinoids, acids, or exfoliants. These exposures may interact with contact lens wear by affecting the eyelid margin, tear film composition, or ocular surface comfort. The present findings therefore highlight the importance of considering skincare behavior as part of ocular surface history in contact lens users. This is particularly relevant in young adults, who often have prolonged digital screen exposure, reduced blink completeness, and long daily contact lens wearing times, all of which may intensify symptoms when tear film stability is compromised (15).

The results are broadly consistent with previous reports linking retinoid exposure, cosmetic products, meibomian gland dysfunction, and ocular surface symptoms. Studies of systemic isotretinoin have shown reduced tear stability and meibomian gland changes, while studies of topical retinoids and active skincare products have reported ocular irritation, dry eye symptoms, lid margin inflammation, and reduced contact lens comfort (16,17). However, the present study adds a focused clinical perspective by examining topical retinol use specifically among young adult soft contact lens wearers. This population is important because contact lens comfort is highly dependent on tear film quality, and even modest tear instability can reduce wearing tolerance.

Several limitations should be considered when interpreting these findings. The cross-sectional design prevents determination of temporal sequence, so it cannot establish whether retinol exposure preceded the onset of contact lens intolerance. Retinol use, frequency, duration, and application area were based on participant reporting, which may introduce recall or classification bias. The study used convenience sampling from a single clinical setting, which may limit generalizability. Potential confounders such as screen time, contact lens hygiene, environmental exposure, cosmetic co-use, artificial tear use, and

detailed meibomian gland grading were not adjusted in multivariable analysis. In addition, meibography, lipid layer thickness assessment, tear osmolarity, and inflammatory markers were not included, limiting mechanistic interpretation.

Despite these limitations, the study provides clinically useful preliminary evidence that topical retinol exposure may be associated with tear film instability and ocular surface symptom burden among young contact lens wearers. The strongest signals were observed in the exposure-response pattern between retinol frequency and reduced TBUT, and between retinol duration and increased OSDI score. These findings support the clinical value of asking contact lens wearers about periocular skincare use when they present with dryness, irritation, or reduced wearing comfort. The overall pattern suggests that topical retinol may not act as a single independent cause of contact lens intolerance but may contribute to ocular surface vulnerability in combination with other behavioral, environmental, and lens-related factors

CONCLUSION

In conclusion, topical retinol use showed a clinically relevant association with ocular surface discomfort among young adult soft contact lens wearers, particularly through reduced tear film stability and increased symptom burden. Contact lens intolerance was more frequent among retinol users than non-users, although the categorical exposure-outcome association did not reach statistical significance in the aggregated comparison. More consistent findings were observed for exposure-related ocular surface measures, as higher frequency of retinol use was associated with shorter tear break-up time and longer duration of use was associated with higher OSDI scores. The pattern of reduced TBUT with preserved Schirmer values suggests that discomfort was more closely related to tear film instability than aqueous tear deficiency. These findings indicate that topical retinol, especially when used frequently or near the periocular region, may contribute to contact lens discomfort in susceptible individuals. Assessment of skincare practices should therefore be incorporated into the clinical evaluation of young contact lens wearers presenting with dryness, irritation, foreign body sensation, or reduced lens tolerance.

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