ORIGINAL ARTICLE

Correlation of Rubbing of Eyes with Keratoconus

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Abstract:

Objective

To investigate the correlation between eye rubbing and the development of keratoconus and to assess the severity of keratoconus in patients who have a history of habitual eye rubbing.

Methods: A cross-sectional observational study was conducted on 120 patients (222 eyes) who were referred to the outpatient department (OPD) due to astigmatism, ocular pain, frequent prescription changes, suspected keratoconus, or for refractive surgery evaluation. Non-probability sequential sampling was used. Ocular history was recorded, including habitual eye rubbing and comprehensive ocular assessment was performed. The KISA% index, derived from topographic data, was used to confirm keratoconus diagnosis. Data were entered and processed using Microsoft Excel, and R software was utilized for statistical analysis. Statistical significance was set at a p-value of less than 0.05.

Results: A total of 120 individuals with 222 eyes (mean age 19.55±5.79 years) were examined in this study. 55.4% of the patients were men and 44.6% were women. After excluding 18 eyes that had previously undergone ocular surgery, 204 eyes remained in the final analysis. Amsler-Krumeich classification was used to stage keratoconus. 52 eyes had stage-1 keratoconus, 42 had stage-2, 14 had stage-3 and 7 had stage-4 keratoconus. Keratoconus and eye rubbing were found to be statistically significant ($p<0.05$)

Conclusion: Our study concludes that rubbing of the eyes is a significant risk factor for the onset of keratoconus and may exacerbate disease progression in diagnosed patients.*Al-Shifa Journal of Ophthalmology 2026; 22(1): 42-48.*

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Introduction:

Nottingham used the term "keratoconus" for the first time in 1854. Ectasia, corneal thinning, and increased curvature are characteristics of keratoconus, a bilateral, asymmetrical, progressive, non-inflammatory condition that eventually results in loss of visual acuity, especially in cases of high irregular astigmatism[1].

Studies have found that the prevalence of keratoconus varies greatly, with estimates from 1 in 500 to 1 in 2000 people worldwide[2]. High prevalence rates have been found in recent studies using corneal topography[3].

Keratoconus was found in 8.8 to 299 cases per 100,000 people annually in the general population. According to reports, the prevalence is 0.3 per 100,000 in russia, 1 in 2,000 in us, and 2,300 per 100,000 in central India[4]. Environmental and demographic factors are among the many factors that influence the development of keratoconus. Atopy, eye rubbing, and UV

exposure are examples of environmental factors, whereas genetic and ethnic variations are examples of demographic factors[5].

Keratoconus is associated with excessive eye rubbing. There are several theories as to how rubbing one's eyes can cause keratoconus. The cornea's elasticity makes it susceptible to shape changes. The frequency and force of rubbing influences the cornea's shape. The keratocyte density in human corneas was found to be significantly reduced after 30 repetitions of a light 10-second eye rub over a 30-minute period. Furthermore, changes in intraocular pressure (IOP) brought on by eye rubbing may indirectly traumatize keratocytes. Keratoconus is the result of keratocytes being traumatized[6] . Numerous studies have shown that increasing the compressive rubbing forces applied to the corneal surface during eye rubbing causes an increase in intraocular pressure (IOP)[7,8].

The patient is typically asymptomatic in the early stages of the illness. Significant vision loss and distortion result from a decline in visual acuity as the disease progresses. Although there is no known cure for this degenerative condition, it can be conservatively treated with contact lenses and glasses to enhance vision. Collagen cross-linking (CXL), penetrating keratoplasty, and intact [9].

Early diagnosis of keratoconus is difficult. The most precise technique for assessing corneal shape and identifying keratoconus is corneal topography, which is based on the ideas of Placido disc and Schimpflug imaging. The gold standard for diagnosing keratoconus is corneal topography. Subclinical keratoconus (KC), also referred to as forme fruste KC, can be diagnosed and its severity graded using a color-coded topographic map of the corneal surface and other parameters. Based on these indices, a number of quantitative techniques have been created. Rabinowitz Rasheed defined the KISA% index, which is used to diagnose KC and consists of four topography indices.[10]. To stage keratoconus, numerous classification schemes have been developed. One of the most widely used methods for diagnosing keratoconus and tracking its development is still the Amsler-Krumeich classification. This grading scheme is based on biomicroscopy, refraction, corneal thickness, and topographic assessment of the anterior corneal surface[11].

There is mounting evidence that persistent eye rubbing can lead to keratocyte structural damage and corneal thinning, both of which are factors in the development of keratoconus. Despite this, there is disagreement over how much rubbing the eyes can contribute to the development and progression of keratoconus. The goal of the research is to ascertain whether excessive eye rubbing is linked to keratoconus and whether the condition can be successfully prevented by avoiding eye rubbing. The gold standard for diagnosing keratoconus is the Galeli G4 dual Scheimpflug.

Methodology:

A cross-sectional study was conducted in the tertiary eye care center, in the corneal department of Al-Shifa Trust Eye Hospital (ASTEH), Rawalpindi, from July 2021 to December 2021. The study was carried out after approval from the Institutional Review Board of Alshifa Trust Eye Hospital, Pakistan, according to the Declaration of Helsinki. In this research 120 patients were evaluated. Non-probability sequential sampling was used. A structured questionnaire was used to record the demographic data of the patients, and the patients' ocular history with respect to rubbing of the eyes was taken. All patients underwent a complete ophthalmic examination. We diagnosed the keratoconus using the KISA% index calculated from corneal topography. In this study, patients with suspected keratoconus, frequent changes of glasses,

ocular discomfort, astigmatism, and refractive surgery were included. Patients who had a history of ocular trauma, intraocular disease, current active eye disease, corneal scarring or pterygium, and contact lens wearers (who had worn soft contact lenses in previous 7 days and hard contact lenses previous 14 days) were excluded from the study. Data were analyzed using (R) version 2024.12.1+563. Qualitative data were presented as frequencies and percentages, and the Chi-square test ($\chi 2$) was used to assess the relationship between variables. A P-value of < 0.05 was considered statistically significant.

Results:

Descriptive Analysis

A total of 222 eyes from 120 participants were included in this study. The study consisted of both genders with a higher representation of men. Specifically, 123 eyes (55.4%) belonged to male participants, while the remaining 99 eyes (44.6%) were from female participants. The mean age of the study participants was 19.55±5.786 years, with participants ranging in age from 10-30 years, indicating a predominance of young individuals affected by or at risk for keratoconus. Systematic history was negative in all cases (N=120,100%). A positive history of spectacle use was reported in 166 eyes (74.8%), suggesting a high prevalence of refractive error in the study population. Additionally, ocular allergy, a known contributor to frequent eye rubbing, was present in 40 subjects (33.3%), highlighting a potential behavioral and environmental link to corneal pathology.

Table 1: Descriptive Statistics of Variables

Variable	Level	N (%)
Gender Male		123 (55.4)
	Female	99 (44.6)
Eye Rubbing	Positive	154 (69.4)
	Negative	68 (30.6)
Spectacle History	Positive	166 (74.8)
	Negative	56 (25.2)
Ocular Allergy	Positive	40 (18.0)
	Negative	182 (82.0)
Systematic History	Positive	0 (0.0)
	Negative	222(100)
KC Diagnosis (KISA%)	Yes	115 (51.8)
	No	107 (48.2)

The severity of keratoconus was classified using the Amsler-Krumeich classification system, which categorizes the disease into four progressive stages based on keratometric readings, astigmatism, corneal transparency, and corneal thickness. Out of a total of 222 eyes examined, 52 eyes were diagnosed with stage 1, 42 eyes with stage 2, 14 eyes with stage 3, and 7 eyes with stage 4 keratoconus based on the Amsler-Krumeich classification system shown in Figure 1.

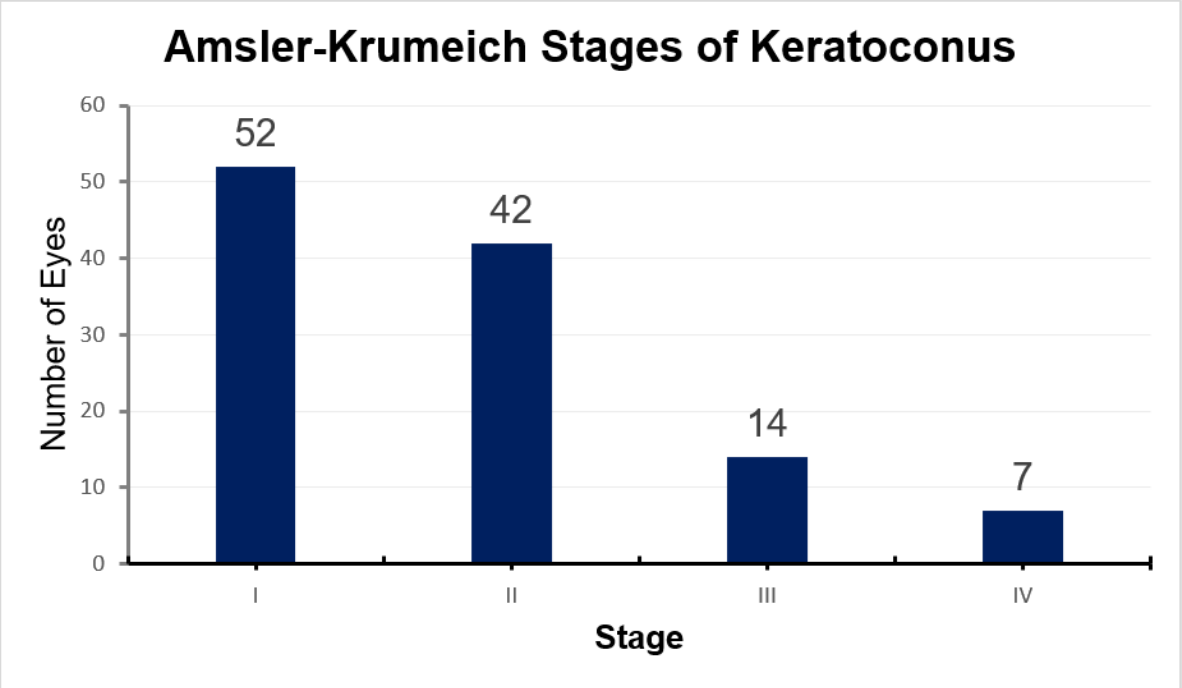

Figure 1: Bar Plot of Eyes by Amsler-Krumeich Stage

Inferential Analysis

Chi-square was used to find the association between rubbing of the eyes with keratoconus. A statistically significant association was found between rubbing of eyes and keratoconus ($p < 0.05$). The following table gives the value of chi-square and p-value of each variable:

Table 2: Chi-Square for Association between Rubbing of Eyes with Keratoconus

Rubbing of eyes	KC positive(N=115)	KC negative(N=107)	Total (N=222)
Yes	107(69.5%)	47(30.5%)	154(100%)
No	8(11.8%)	60(88.2%)	68(100%)
Chi-square $\chi 2$(df)	33.315(1)	P=0.000	

Discussion:

This study investigated the correlation of rubbing of the eyes with the development of keratoconus. Table 2 shows a substantial correlation between eye rubbing and Keratoconus ($X2(1) = 33.315$, $p < 0.000$). A much larger proportion (69.5%) of respondents who reported rubbing their eyes were found to have Keratoconus, compared to only 11.8% of those who did not rub their eyes. In contrast, the majority of those who did not rub their eyes 88.2% did not have Keratoconus. These findings support the previously held belief that frequent eye rubbing may add to or worsen the likelihood of developing

Keratoconus. The highly substantial p-values suggested that public health efforts to discourage regular eye rubbing could prevent or reduce the incidence of Keratoconus. The findings of this study are consistent with previous research demonstrating that a complex interaction between genetic vulnerability and behavioral or environmental factors causes keratoconus. Numerous epidemiological and clinical investigations have shown that eye rubbing is the most important modifiable factor linked to KC. According to Gordon-Shaag et al, 2013, persistent rubbing is a major external trigger that interacts with genetic propensity to cause corneal ectasia[5]. In a similar vein, Debourdeau et al, 2022 discovered that eye rubbing increased the risk of KC with an odds ratio of 10.9, whilst family history revealed an OR of 22.2[12]. Additionally, Moran et al, 2020 noted that rubbing with knuckles increases mechanical stress, indicating that the kind and degree of rubbing affect corneal injury[13].

Large-scale prevalence studies provide additional evidence of the substantial correlation between rubbing and KC. While rubbing itself did not achieve statistical significance in that sample, Millodot M et al, 2011, reported a KC prevalence of 2.34% in Jerusalem, which was considerably greater among males. They also found that atopy and familial history were important predictors[15], while a study conducted on a Lebanese medical student screening trial showed no significant correlation of atopy and rubbing of eyes with keratoconus[14].

Yang K et al, 2022, on the other hand, showed incredibly strong correlations, with eye rubbing showing an OR of 15.11 and atopy an OR of 5.30 particular, the cohabitation of rubbing and atopy raised risk by more than 50-fold. All of these results point to rubbing as a key mechanism, and allergy symptoms probably work indirectly by making people more eager to rub[17].

These correlations are supported by meta-analytic data. The hypothesis that rubbing is the predominant behavioural mechanism is supported by Seth et al, 2023, who reported pooled odds ratios of 5.22 for eye rubbing and 6.67 for family history, although atopy showed a smaller connection[16]. Rubbing raises the incidence of KC by more than six times, according to a second comprehensive review, in which casual interpretation is limited by the variation in study methods[18]. However, these analyses highlight the consistency and biological plausibility of the connection.

Evidence at the molecular level provides important mechanistic insights. The concept that mechanical trauma, rather than immune-mediated inflammation, promotes KC phenotypic expression is highly supported by Jaskiewicz K et al, 2023, who demonstrated that rubbing initiates pathways including apoptosis (TP53, BCL2L1), stress response, and altered cell adhesion within the corneal epithelium[19]. This settles the contentious link between allergies and keratoconus; itching-induced rubbing becomes the harmful agent, but allergic illnesses by themselves are insufficient to cause keratoconus[16].

Environmental factors seem to be important as well. It is found that dust exposure had a significant effect[19]. Increased screen time is associated with the beginning of KC, causes dryness and irritation, and encourages rubbing behaviour[13]. When taken as a whole, these variables represent cumulative epithelial stress that speeds up stromal thinning.

The necessity of public education is shown by awareness studies. Only 26% of participants in a Saudi Arabian poll have a strong understanding of keratoconus, despite the fact that 81.4% of them massaged their eyes[20]. This discrepancy implies that teaching populations about the dangers of rubbing, particularly in areas with high KC prevalence, may lessen the clinical burden.

Conclusion:

This study demonstrates a significant positive correlation between eye rubbing and the presence of keratoconus, supporting the hypothesis that mechanical trauma may play a contributory role in the development and progression of keratoconus. These findings highlight the importance of patient education regarding the harmful effects of habitual eye rubbing and behavioral intervention in reducing the modifiable risk factors. By addressing behavioral contributors early, there is potential not only to delay the onset of keratoconus but also to reduce its severity and the need for invasive interventions in the long term.

References:

1. Kordi ES, Almokhtar AM, Alshareef EK, Alkayyal AA, Alharbi JO, Alharbi AH, Kordi E, Almokhtar A, Alharbi A. Awareness about keratoconus and its relation with eye rubbing: a cross-sectional study in Medina. Cureus. 2022 Nov 29;14(11).
2. Romero-Jiménez M, Santodomingo-Rubido J, Wolffsohn JS. Keratoconus: a review. Contact Lens and Anterior Eye. 2010 Aug 1;33(4):157-66.
3. Hashemi H, Beiranvand A, Khabazkhoob M, Asgari S, Emamian MH, Shariati M, Fotouhi A. Prevalence of keratoconus in a population-based study in Shahroud. Cornea. 2013 Nov 1;32(11):1441-5.
4. Vazirani J, Basu S. Keratoconus: current perspectives. Clinical ophthalmology. 2013 Oct 14:2019-30.
5. Gordon-Shaag A, Millodot M, Shneor E. The epidemiology and etiology of keratoconus. International Journal of Keratoconus and Ectatic Corneal Diseases. 2013 Dec 1;1(1):7-15.
6. Najmi H, Mobarki Y, Mania K, Altowairqi B, Basehi M, Mahfouz MS, Elmahdy M. The correlation between keratoconus and eye rubbing: a review. International journal of ophthalmology. 2019 Nov 18;12(11):1775.
7. Kelly DJ, Farrell SM. Physiology and role of intraocular pressure in contemporary anesthesia. Anesthesia & Analgesia. 2018 May 1;126(5):1551-62.
8. Liu WC, Lee SM, Graham AD, Lin MC. Effects of eye rubbing and breath holding on corneal biomechanical properties and intraocular pressure. Cornea. 2011 Aug 1;30(8):855-60.
9. Lass JH, Lembach RG, Park SB, Hom DL, Fritz ME, Svilar GM, Nuamah IF, Reinhart WJ, Stocker EG, Keates RH, Moran CT. Clinical management of keratoconus: a multicenter analysis. Ophthalmology. 1990 Apr 1;97(4):433-45.
10. Bibi A, Naeem A, Ahmad S, Ullah S, Firdous M, Hamza M, Qayyum S. To determine the sensitivity and specificity of retinoscopy in diagnosis of keratoconus. Int J Sci Eng Res. 2022;13:638-44.
11. Giannaccare G, Murano G, Carnevali A, Yu AC, Vaccaro S, Scuteri G, Maltese L, Scorcia V. Comparison of amsler–krumeich and sandali classifications for staging eyes with keratoconus. Applied Sciences. 2021 Apr 28;11(9):4007.
12. Debourdeau E, Planells G, Chamard C, Touboul D, Villain M, Demoly P, Babeau F, Fournie P, Daien V. New Keratoconus Risk Factors: A Cross-Sectional Case—Control Study. Journal of Ophthalmology. 2022;2022(1):6605771.
13. Moran S, Gomez L, Zuber K, Gatinel D. A case-control study of keratoconus risk factors. Cornea. 2020 Jun 1;39(6):697-701.
14. Waked N, Fayad AM, Fadlallah A, El Rami H. Keratoconus screening in a Lebanese students' population. Journal francais d'ophtalmologie. 2011 Jun 29;35(1):23-9.
15. Millodot M, Shneor E, Albou S, Atlani E, Gordon-Shaag A. Prevalence and associated factors of keratoconus in

Jerusalem: a cross-sectional study. Ophthalmic epidemiology. 2011 Apr 1;18(2):91-7.
16. Seth I, Bulloch G, Vine M, Outmezguine J, Seth N, Every J, Daniell M. The association between keratoconus and allergic eye diseases: A systematic review and meta-analysis. Clinical & Experimental Ophthalmology. 2023 May;51(4):O1-6.
17. Yang K, Li D, Xu L, Pang C, Zhao D, Ren S. Independent and interactive effects of eye rubbing and atopy on keratoconus. Frontiers in immunology. 2022 Sep 29;13:999435.
18. Sahebjada S, Al-Mahrouqi HH, Moshegov S, Panchatcharam SM, Chan E, Daniell M, Baird PN. Eye rubbing in the aetiology of keratoconus: a systematic review and meta-analysis. Graefe's Archive for Clinical and Experimental Ophthalmology. 2021 Aug;259(8):2057-67.
19. Jaskiewicz K, Maleszka-Kurpiel M, Michalski A, Ploski R, Rydzanicz M, Gajecka M. Non-allergic eye rubbing is a major behavioral risk factor for keratoconus. PLoS One. 2023 Apr 13;18(4):e0284454.
20. AlSomali A, Almithn D, Alamer A, Al-Omair A, Almuhaysin F, Almulhim N, AlSomali AI, Almithn Jr DM, Alamer AK, Almuhaysin FA, Almulhim NI. Awareness of Keratoconus and Its Relationship With Eye Rubbing Among the Population of the Eastern Province of Saudi Arabia. Cureus. 2024 Jan 3;16(1).

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