Original Article

Clinical Profile on Keratoconus Presenting at A Tertiary Eye Care Centre- Tilganga Institute of Ophthalmology

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Abstract

Introduction: Keratoconus (KC), is a bilateral, noninflammatory degenerative disease of the cornea which is characterized by progressive corneal ectasia and loss of visual function. The onset of KC is commonly seen at puberty and affects approximately 1 in 2000 in the general population.

Objective: The aim of this study was to assess the clinical profile of keratoconus in the tertiary eye centre in Nepal.

Material and methods: It is a retrospective, hospital based, consecutive study from June 2017 to May 2018. A total of 66 patients (114 eyes) were diagnosed cases of Keratoconus presented in Cornea clinic of Tilganga institute of Ophthalmology. Parameters investigated included patients' demography, keratometric readings, visual acuity and manifest refraction. Classification of keratoconus was based on Amslern-Krumeich grading system (modified).

Results: The mean age of subjects was 18.73 (range: 10-65). Male/female distribution was 48 (72.7%) and 18 (27.3%) respectively. 48 (72.7%) had bilateral keratoconus and 18 (27.3%) were unilateral. Mean Uncorrected visual acuity (UCVA) was 0.80(range: 0.01-1.00), mean visual acuity (VA) with spectacle correction was 0.47 (range: 0.01-1.00). Mean spherical amount of refractive was – 2.17(range: −0.50 to −17.00D) and mean cylindrical amount of refraction was -2.85 (range: 0.00 to −6.00). Mean spherical equivalent (SE) of refraction was −4.26 (range: −0.50 to −22.50D).

Mean flattest keratometric reading (K1) was 49.63 (range: 40.63-76.70D) and mean steepest keratometric reading (K2) was 53.14 (range: 41.63-73.21D). Mean average keratometric reading was 51.43 (range: 41.63-72.10D). Regarding disease severity, 35.68% of subjects were classified as mild keratoconus, 29.73% as moderate keratoconus, 9.73% as advance keratoconus, while 24.86% were found with the severe stage of keratoconus. 78.9% of total eyes presented with minimum pachymetry of 401 to 500 mm.

Conclusion: Clinical profile of Nepalese keratoconus patients looks similar to that reported earlier worldwide. The condition was found to manifest at a younger age and was more common in males.

Key words: Keratoconus, Keratometer, keratometric reading, manifest refraction, spherical equivalent, Dioptre (D).

Introduction

Keratoconus (KC), is a bilateral, noninflammatory degenerative disease of the cornea which is characterized by progressive corneal ectasia and loss of visual function. The onset of KC is commonly seen at puberty and affects approximately 1 in 2000 in the general population. [Kennedy RH et. al. 1986]. Incidences of 1 in 600 to 1 in 420 seem to be more with modern diagnostic tools [Caporossi A et. al. 2006]. Keratoconus can be manifested as a "forme fruste" or subclinical condition which is only detectable by computer videokeratoscopy.

Some presented with typical biomicroscopy signs: apical protrusion with corneal thinning and scarring, Vogt's striae and Fleisher's ring. KC is progressive in 20% of cases and it was the leading indication for penetrating keratoplasty (21.2%) and anterior lamellar keratoplasty (40.2%) in the United States in 2010.Classically its onset is at puberty and progresses until the third or fourth decade of life, when it usually arrests [Rabinowitz Y et. al. 1998]. Clinically, KC leads to myopia and irregular astigmatism and ruptures in Descemet's membrane may occur in severe cases resulting in corneal edema and scarring [Krachmer JH et. al. 1984]. Because most of the patients are young, keratoconus often has an adverse impact on quality of life [Kymes SM et. al. 2004].

Methodology

It is a hospital based, retrospective study from June 2017 to May 2018. The included patients were diagnosed keratoconus patients who were referred by ophthalmologists and optometrists for further management in Cornea clinic at Tilganga institute of Ophthalmology Kathmandu, Nepal. Any patient with a history of ophthalmic surgery or ophthalmic disease other than keratoconus was excluded from this study. Parameters investigated included patients demography, keratometric readings, visual acuity and manifest refraction. The parameters reviewed were patient's age, gender, laterality keratometric reading (steepest, flattest, and mean), slit lamp biomicroscopic findings, manifest refraction,UCVA using Snellen chart and BCVA. For statistical analysis, Snellen visual acuity (VA) values were converted to Logmar chart. Keratoconus can be classified according to the severity level (based on central keratometric [K] reading). In this study, the central corneal curvature values measured by keratometer following the Amsler-Krumeich grading system was selected for classification of Keratocous.(Kennedy RH et al., 1986) Mean K was calculated automatically from the mean value of flattest and steepest central curvatures. Accordingly, keratoconus was classified as mild, moderate, advanced, and severe.

Results were evaluated using statistical analysis software (IBM SPSS 20). Descriptive statistics (mean,standard deviation [SD], frequency) were carried out for all study parameters. The relationships between age and mean keratometric reading, manifest refraction, BCVA, spherical amount of refraction and SE of refraction were analyzed using Pearson's and Spearman correlation coefficient . Significant level was <0.05.

Results

A total of 66 diagnosed keratoconus patients' records (114 eyes) were retrospectively reviewed. The mean age of subjects was 18.73 (range: 10-65) (figure 1). Out of total participants, 48 (72.7%) were male and 18 (27.3%) were female (figure 2). In our study,48 (72.7%) had bilateral keratoconus and 18 (27.3%) were diagnosed as unilateral keratoconus (figure 3).

Mean unaided VA was 0.80 (range: 0.01-1.00), mean VA with spectacle correction was 0.47 (range: 0.01-1.00). Majority of eyes (286 eyes, 77.29%) showed BCVA of 0.7 (6/9) or better.

In term of refractive status, mean spherical amount of refraction was – 2.17(range: −0.50 to −17.00D) and mean cylindrical amount of refraction was -2.85 (range: 0.00 to −6.00). Mean spherical equivalent (SE) of refraction was −4.26 (range: −0.50 to −22.50D). Mean flattest keratometric reading (K1) was 49.63 (range: 40.63-76.70D). Mean steepest keratometric reading (K2) was 53.14 (range: 41.63-73.21D). Mean average keratometric reading was 51.43 (range: 41.63-72.10D). Regarding disease severity, 35.68% of subjects were categorized as mild keratoconus, 29.73% as moderate keratoconus, 9.73% as advanced keratoconus, while 24.86% were found with the severe stage of keratoconus.

Table 1: Illustrates the demographic profile of characteristics of study subjects

Data (66 Participants, 114 eyes)	Frequency (%)
Age	
Mean (years)	18.75
Range (years)	5-29'
SD	6.26
Gender (n=66)	
Male	48(72.7%)
Female	28 (27.3%)
Laterality of KC (n=66)	
Bilateral	48 (72.7%)

Table 2: Distribution According to Severity of Keratoconus

Severity of Keratoconus (Dioptres)	No. of Eyes	Percentage
<48	51	44.7%
48 to 53	45	39.5%
>53 to 55	5	4.4%
>55	13	11.4%
Total	114	100.0%

Table 3: Showing K readings.

N	K1	K2	K MEAN
Mean	47.30	51.93	49.46
SD	4.46	5.52	4.58
Minimum	40.90	44.10	43.20
Maximum	65.40	73.40	67.10

Table 4: Correlation of age with various parameter

| Correlation with p value			
		r	p
Pearson Coefficient	Age and mean refraction	0.211	0.035
	Age and K mean value	0.192	0.054
Spearman Coefficent	Age and mean BCVA	0.048	0.615
	Age and spherical amount of Refraction	-0.019	0.841
	Age and SE of Refraction	0.045	0.635

Table 5: Correlation of age and gender.

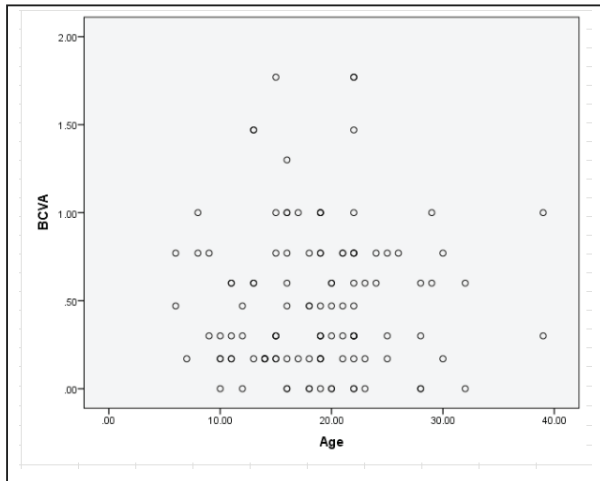| Gender	N	Mean	SD	P value
Male	48	17.3	6.1	0.08
Female	18	20.4	7.4	
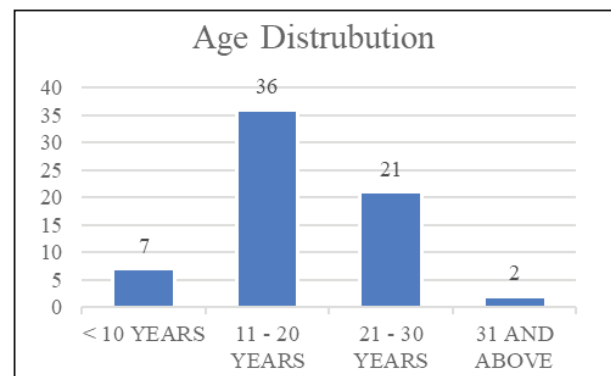
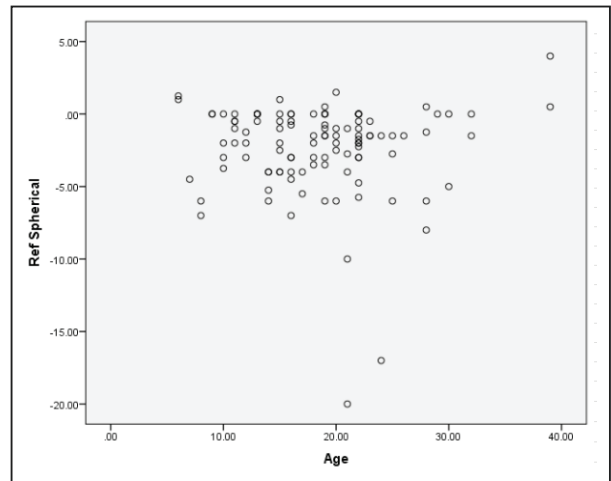**Figure 1:** Demographic characteristic of patients according to age
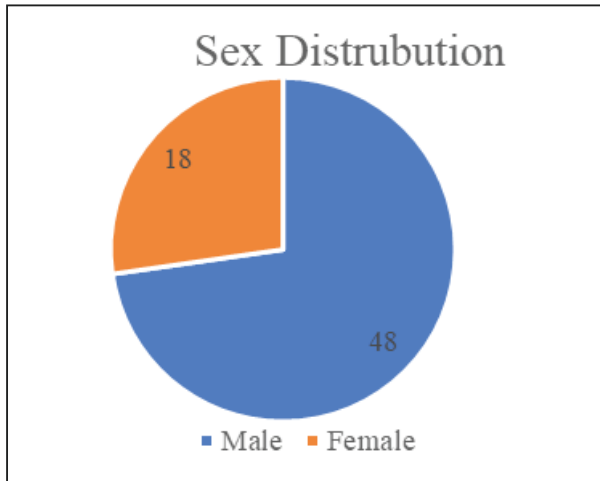
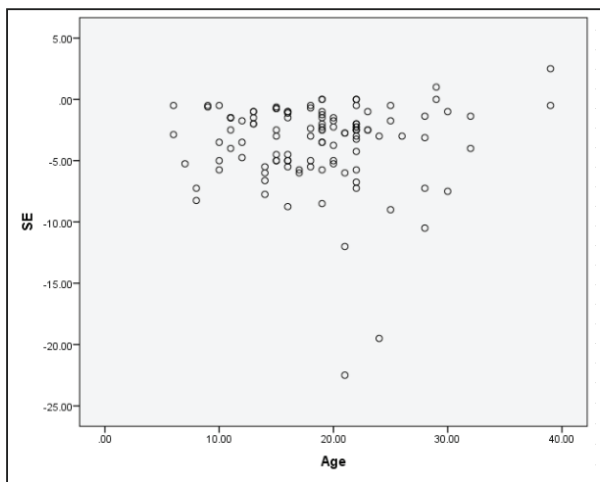**Figure 2:** Demographic characteristic of patients according to sex
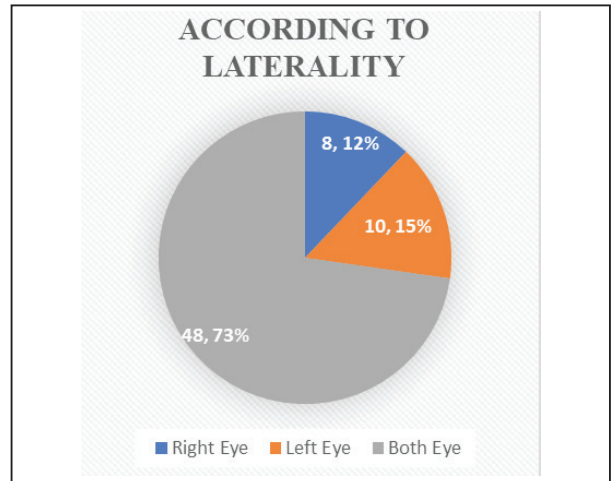
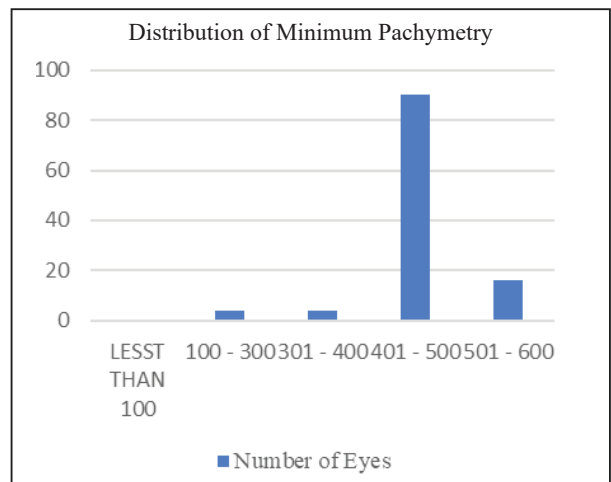**Figure 3:** Demographic characteristic of patients according to laterality

Figure 4: Correlation of Age and BCVA

Figure 5: Correlation of Age and Spherical amount of Refraction

Figure 6: Correlation of Age and SE of refraction

Figure 7: Distribution according to minimum pachymetry.

Discussion

Although several studies have been conducted in Asians and Caucasians, there are lacunae in literature regarding the incidence of keratoconus in Nepal. Kok et al. 2012 reported that Asians were younger at diagnosis (18-24 years). Another study by Georgiou et. al also found that Asian patients with keratoconus in UK were significantly younger at disease presentation than in Whites. Similarly, the current study showed a mean age of keratoconus patients was 18.75 years. Minimum age was 5 years and maximum years was 39 years. Standard deviation was 6.26.

The study done in Sudan (M.abdu et al,2016) reported that mean age of 21.43 yrs. Other study done in Malaysia mentioned a mean age at the time of diagnosis was 21.46 (range, 9–38, median 29) years old, being 21.96 for males and 20.20 for females.

Knowledge regarding difference in gender is beneficial for the prevention, diagnosis and management of diseases. In this study, majority of patients were male which includes 48 (72.7%) and female being 18(27.3%). This is a similar finding of many recent studies which reported that most keratoconus patients were males. Study done in Malaysia (Mohd Ali et al, 2012), a higher percentage of males (55.8%) was found to have keratoconus. Owens and Gamble found that 59% out of 673 keratoconus patients in New Zealand (Owens et al,2003) were males. Lim and Vogt also reported a predominance of males (61.5%) in their study on keratoconus. Recently, in the Singapore study there is a predominance of males (62.9%) than females. Keratoconus usually involves both eyes, but can affect one eye earlier than the other. (Kennedy RH et al,1986).

The prevalence of unilateral keratoconus ranges from 14.3% to 41% in several earlier studies. (Kennedy et al.,1986). This study reported that 72.7% participants had bilateral involvement and 27.3% had unilateral involvement. Other

study done in Malaysia showed that around 77% of the cases were bilateral keratoconus. The study done in Sudan showed that 22.1% of the subjects were presented with unilateral keratoconus. This finding was more as compared to Wilson *et al.* 1991 who reported prevalence from only 0.5% to 4% of unilateral keratoconus using computerized video keratoscopic techniques. Variations between studies may be due to difference in methods used for diagnosing keratoconus. Higher number of bilateral keratoconus found in this study may be due to subjects were referred from a higher center.

There is no statistically significant difference was detected between gender and age (P value 0.08). This result indicated that keratoconus affects both genders in a similar age. This is in contrast with a study by Fink *et al* 2005, who found that the mean age of women at the time of diagnoses was older than that of men. The authors suggested the chances of keratoconus to develop at an earlier age in men and progresses more rapidly.

With regard to vision data, mean uncorrected visual acuity was 0.80 Log mar (range 0-1.78) SD 0.41, mean BCVA was 0.49 logmar SD 0.35 (Range 0.30-1.78). According to visual impairment criteria 42 eyes falls into the criteria (<6/18).

In term of refractive status, mean spherical amount of refraction was − 2.17(range: −0.50 to −17.00D) and mean cylindrical amount of refraction was -2.85 (range: 0.00 to −6.00). Mean SE of refraction was −4.26 (range: −0.50 to −22.50D). Among them, 4 eyes refraction could not be assessed due to difficult mires.

In a study done in Malaysia showed mean refraction in spherical equivalent was −6.19 ± 5.37D and mean BCVA was 0.75 ± 0.25 (6/9 Snellen). Similar results were found out in a study done in Sudan mean unaided VA was 0.19 ± 0.18 (range: 0.01-1.00), mean VA with spectacle correction was

0.43 ± 0.27 (range: 0.01-1.00). Majority of eyes (286 eyes, 77.29%) showed VA of 0.7 (6/9) or better. In term of refractive status, mean spherical amount of refraction was −5.59 ± 4.14 (range: −0.50 to −22.0D) and mean cylindrical amount of refraction was −4.34 ± 2.77 (range: 0.00 to −19.00). Mean spherical equivalent (SE) of refraction was −6.93 ± 4.80 (range: −0.50 to −23.00D). AGE- Pearson correlation analyses were performed between age of onset and mean K reading as well as between age of onset and mean refraction. The results showed no statistically significant correlation between mean K versus age of onset ($p = 0.054$, $r = 0.192$) and positive statistically significant correlation between mean refraction versus age of onset ($p = 0.035$, $r = 0.211$). Spearman correlation were performed between age of onset and BCVA, between age and spherical amount of refraction as well as between age and SE of refraction. The results showed positive significant correlation between age and BCVA (p =0.048, r =0.61), negative and no statistically significant correlation between mean spherical amount of refraction versus age (p =-0.19, r =0.84) and also no significant correlation between SE of refraction versus age (p =0.45, r = 0.63).

In this study, the central corneal curvature values measured by keratometer following the Amsler-Krumeich grading system was selected for classification of Keratocous.study. Mean K was calculated automatically from the mean value of flattest and steepest central curvatures. According to Amsler–Krumeich grading system,44.7% were categorized as stage I (mild), 39.5% stage II (moderate), 4.4% stage III (advanced) and 11.4% stage IV (severe) keratoconus at the time of diagnosis. With regard to corneal power and curvature, mean flattest keratometric reading (K1) was 47.30 D range:40.90 – 65.40 D). Mean K2 was 51.93 D (range: 44.10 -73.40 D). Mean

average keratometric reading was 49.46 D (range: 43.20– 67.10 D). In the study done by Mustafa Abdu and Kamad regarding clinical profile of Keratoconus in Sudan they found 35.68% of subjects as mild keratoconus, while 24.86% were found with the severe stage of keratatoconus. The study done by Mohd Ali et. al. 2012, regarding clinical profile of keraroconus in Malaysia they found 37.6% were categorized as stage I, 30.1% stage II, 4.4% stage III and 27.8% stage IV keratoconus at the time of diagnosis. Mean keratometer reading was 51.27 ± 5.91D and mean K2 was 51.26 ± 5.91D. Both studies have shown similar parameters regarding the degree of severity of keratoconus and keratometry values. Among 114 eyes, 90 eyes presented in our OPD with minimum pachymetry of 401-500 mm which represents 78.9 %. This table showed mean of 452.1 mm, minimum thickness being 64 mm and maximum of 575 mm. Standard deviation of 72.9.

Older patients were presumed to have more severe disease due to the progression of the condition. Wagner *et al*. 2007 stated that early incidence of keratoconus was associated with worsening of disease. However, in this study, there was no statistically significant correlation between age and disease severity, and between age and refractive error, and between age and mean K, but a significant negative correlation was detected between age and VA without correction, with glasses. These results suggest that age may be not a factor in determining the level of severity of the disease but it may be a factor in determining visual outcomes.

Conclusion

Clinical profile of Nepalese keratoconus patients looks similar to that reported earlier worldwide. The condition was found to manifest at a younger age and was more common in males.

References

Abdu M, Binnawi KH, Elmadina AM, Hassan R (2016). Clinical profile of keratoconus patients in Sudan. Sudanese J Ophthalmolology;8:20-5.

Caporossi A, Baiocchi S, Mazzotta C, Traversi C, Caporossi T (2006). Parasurgical therapy for keratoconus by riboflavin-ultraviolet type A rays induced cross-linking of corneal collagen. Preliminary refractive results in an Italian study. Journal of Cataract and Refractive Surgery;32(5):837–845.

Fink BA, Wagner H, Steger-May K, Rosenstiel C, Roediger T, McMahon TT, et al (2005). Differences in keratoconus as a function of gender. Am J Ophthalmology;140:459-68.

Georgiou T, Funnell CL, Cassels-Brown A, O'Conor R (2004). Influence of ethnic origin on the incidence of keratoconus and associated atopic disease in Asians and white patients. Eye (Lond);18:379-83.

Kennedy RH, Bourne WM, Dyer JA (1986). A 48-year clinical and epidemiologic study of keratoconus. Am J Ophthalmology;101(3):267-73.

Khor WB, Wei RH, Lim L, Chan CM, Tan DT (2011). Keratoconus in Asians: Demographics, clinical characteristics and visual function in a hospital-based population. Clin Experiment Ophthalmology;39:299-307.

Kok YO, Tan GF, Loon SC (2012). Review: Keratoconus in Asia. Cornea ;31:581-93.

Krachmer JH, Feder RS, Belin MW (1984). Keratoconus and related noninflammatory corneal thinning disorders. Surv Ophthalmology;28(4):293-322.

Kymes SM, Walline JJ, Zadnik K, Gordon MO (2004). Quality of life in keratoconus. American Journal of Ophthalmology;138(4):527–535.

Leopoldo Spadea, Serena Salvatore, and Enzo Maria Vingolo (2013). Corneal Sensitivity in Keratoconus: A Review of the Literature, Scientific World Journal.

Rabinowitz Y (1998). Keratoconus. Survey of Ophsthalmology;42:297–331.

Lim N, Vogt U (2002). Characteristics and functional outcomes of 130 patients with keratoconus attending a specialist contact lens clinic. Eye (London);16:54- 9.

Mazzotta C, Traversi C, Baiocchi S, et al (2008). Corneal healing after riboflavin ultraviolet-A collagen cross- linking determined by confocal laser scanning microscopy in vivo: early and late modifications. American Journal of Ophthalmology;146(4):527–533.

Mohd-Ali B, Abdu M, Yaw CY, Mohidin N (2012). Clinical characteristics of keratoconus patients in Malaysia: A review from a cornea specialist center .J.Optom;5:38-42.

Owens H, Gamble G (2003). A profile of keratoconus in New Zealand. Cornea;22:122-5.

Rabinowitz YS, Yang H, Rasheed K, Li X (2003). Longitudinal analysis of the fellow eyes in unilateral keratoconus. IOVS ;44:1311-5

Wagner H, Barr JT, Zadnik K (2007). Collaborative Longitudinal Evaluation of Keratoconus (CLEK) study: Methods and findings to date. Cont Lens Anterior Eye;30:223-32.

Steven E Wilson, David T.C.Lin, Stephen D. Klyee (1991). Corneal topograohy of Keratoconus.Cornea;10(1):2-8.

Zadnik K, Barr JT (2002). Keratoconus. In: Efron N, editor. Contact Lens Practice. New Delhi: Butterworth-Heinemann; p. 301-12.

Zaki Al Shammari., et al (2016). "Prevalence, Clinical Features and Associated Factors of Keratoconus Patients Attending Ophthalmology Department, King Khalid Hospital, Hail City, Saudi Arabia". EC Ophthalmology 3.5 : 388-400.