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Research article

Assessment of Topographic Patterns in Vernal Keratoconjunctivitis

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Abstract

Purpose: To determine topographic pattern and corneal pachymetry of eyes with vernal keratoconjunctivitis (VKC) and to detect the incidence of keratoconus.

Participants: Fifty patients with VKC and 50 normal Subjects aged 9 to 22 years attending to Mansoura Ophthalmic Center.

Methods: Slit lamp findings of VKC and keratoconus were recorded. Corneal topographic patterns, astigmatism, inferior superior (I-S) dioptric values, central keratometry and thinnest pachymetry were measured.

Results: Patients with VKC had more abnormal corneal topographic patterns, higher maximal corneal dioptric power, increased superior to- inferior asymmetry with tendency to more superior steeping and thinner cornea with higher incidence of keratoconus when compared with normal subjects.

Conclusion: Patients with VKC have more abnormal topographic patterns with high incidence of keratoconus than normal.

Keywords: *Vernal Keratoconjunctivitis (VKC); Slit Lamp; Keratoconus; Inferior Superior (I-S)*

Introduction

(VKC) is a chronic allergic disease with seasonal periods of exacerbations predominately observed in children and young adults. The disease does not usually result in permanently damaged vision except in its sever and persistent form which frequently leads to corneal tissue damage and disturbs visual function. Keratoconus is a bilateral non inflammatory corneal ectasia with an incidence of approximately 1/2000 in the general population generally manifests after puberty and courses with progressive myopic astigmatism. Several studies have shown an association between osteoarthritis and allergic reaction [1,2].

Keratoconus (KC) is increasingly thought to be multifactorial in its pathogenesis [3]. Environmentally related risk Factors such as eye rubbing are well documented [4]. An underlying genetic component in the pathogenesis of KC is compelling [5,6]. Videokeratography

provides a rapid repeatable and objective means of identifying corneal abnormalities such as early keratoconus (KC) when other characteristic signs of the disease may be absent [7,8].

Although advanced keratoconus has well described clinical signs, sub clinical keratoconus may go undetected on slit lamp examination. Form fruste or sub clinical keratoconus (FFKC) was described by Maguire and Bourne in 1989 [9]. It is defined as the appearance of corneal steepening suggestive of keratoconus on corneal topography but with normal corneal findings on slit lamp examination. Several reports have used quantitative analysis of topographic maps to detect FFKC in subjects with VKC in order to find the overall incidence of keratoconus [10].

Purpose of the Study

The purpose of this study was to evaluate the incidence of keratoconus VKC population by quantitively analysis of topographic map to find the overall incidence of keratoconus in general population and to detect characteristics of VKC.

Subjects and Methods

All subjects were recruited from subjects aged 9 to 22 years presenting to out patient's clinic of Mansoura Ophthalmic Center during the period July 2007 to April 2008.

All subjects underwent ophthalmological examination including refraction, best corrected visual acuity, assessment of intraocular pressure, axial length measurements, slit lamp biomicroscopy and fundus examination.

The diagnosis of VKC was made on the basis of typical clinical history of severe itching with characteristic clinical signs including giant papillae on the upper palpebral conjunctiva, limbal infiltrate and eosinophilic concretion. The VKC was catergorized as limbal, palpebral or mixed as categorized by cameron [1]. The diagnosis of keratoconus was based on slit lamp biomicroscopic findings: Vogt striae, Fleischer ring, stromal thinning and stromal scaring [13,14].

The patients or their parents were interviewed as to details of history including age of onset of itching and visual difficulties, estimated frequency of abnormal eye rubbing, previous treatment and presence of allergic disease. Subjects with any other ocular pathology, previous refractive surgery, stromal scarring due to acute hydrops or any other corneal opacity were excluded.

Topography

Subjects who met the eligibility criteria, were submitted to topography. (TM2- topographic Modeling system II Tomey USA). All corneal topography was performed with the patient instructed to blink several times before lubricant. Two consecutive measurement were taken for each eye in order to minimize the possible effect of tear film. On the basis of the quality of images by visual inspection and the index rating from topography soft ware the best map from each participate was selected. Patients whose topography maps seemed suspicious for KC were asked to return for further corneal topography analysis on a separate day. Identified parameters were central keratometry (CK; derived from the peak central corneal radius given by Medmort software program), inferior-superior I-S dioptric value calculated by taking the dioptric difference between corneal power 2.5 mm above and 2.5 mm below center cornea and. astigmatism (derived from power difference between the 2 principal corneal meridia, generated automated by indices were chosen because they are largely from those calculated by Rabinowitz., *et al* [14].

Corneal topographic morphologic features were analysed according to the definitions of Minor simplification were inserted that divide the topography pattern in to normal (round, oval, symmetric bow tie) abnormal pattern asymmetrical bow tie superior steeping, asymmetrical bow tie inferior steeping and irregular pattern [14] (Figure 1 and 2).

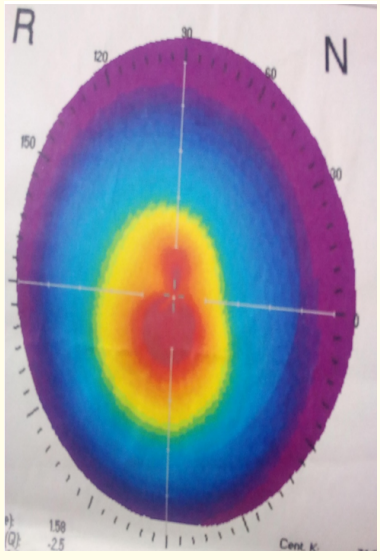

Figure 1: *A case of spring catarrh with keratoconus.*

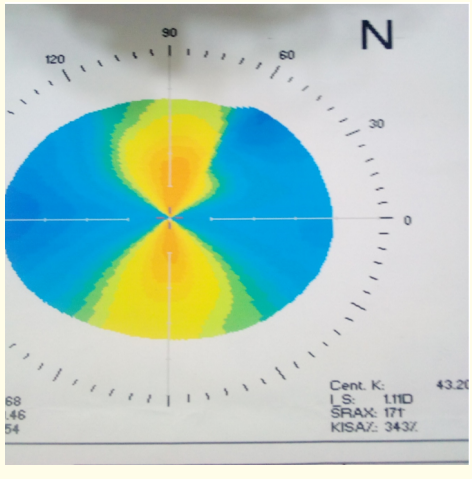

Figure 2: *Another case of spring catarrh with bow tie.*

Pachymetry

Sound pachymeter 4000 AP USA was used. The center of the cornea was measured.

Rabinwitz and MC Donnel originally used central corneal power and inferior superior asymmetry I.S value as well as the difference in the central corneal power between the two eyes of a given subject [16]. While modified Rabinowitz MC Donnell criteria of Maeda were used only the central corneal power and I.S value to detect keratoconus cases in VkC [17].

All the data the corneal topography maps were compared with clinical measurements which include spherical equivalent, severity of VKC and signs and symptoms of keratoconus.

Statistical analysis

The statistical tests used were Pearson chi- square tests and Kolmogorov-Smirnov test for equality of variances ($p < 0.05$ considered statistically significant).

Results

The study included 100 subjects. Fifty patients had VKC with a mean age of 13 years. Male predominance (74%) was found in VKC. The study included another 50 normal subjects as a control group (Table 1).

		VKC	Control
Age	Mean ± SD	13 ± 4 years old	12 ± 5year
	Range	10 - 20 years old	9 - 22 year
Sex	Male	37 (%74)	25 (50%)
	Female	13 (26%)	25 (50%)

Table 1: *Demographic findings.*

This table shows the number of male exceed that of females in VKC.

The symptoms of VKC were seasonal in 30 subjects and throughout the year in 20 subjects. In all cases, the onset of VKC symptoms preceded the visual complaints of patients. Thirty patients (60%) were noted to rub their eyes frequently (> 10 times daily). Thirteen patients (26%) rubbed their eyes occasionally (5 - 10 times daily) and 7 patient 14% rarely rubbed their eyes (< 5 times daily). VKC type was mixed in 35 patients 70%, palpebral in 10 patients 20% and limbal in 5 patients (10%) (Table 2).

Types	Number of patient
Palpebral	10 (20%)
Limbal	5 (10%)
Mixed	35 (70%)

Table 2: *Types of VKC.*

Patterns of corneal topography were abnormal in 85% of KC versus 30% of the control. There was a definite trend to superior steeping (negative value for I-S index) in the VKC group ($p = 0.05$) (Table 3 and figure 1).

	VKC			Control		
Normal patterns	**Right**	**Left**	**Both**	**Right**	**Left**	**Both**
Round	1	2	3	10	15	25
Oval	0	1	1	3	2	5
Symmetrical bow tie	5	6	11	20	20	40
Abnormal patterns						
Asymmetrical bow tie with Superior steeping	30	35	65	7	9	16
Inferior steeping	10	5	15	9	3	12
irregular	4	1	5	1	1	2
Total	50	50	100	50	50	100

Table 3: *Distribution of topographic patterns.*

This table shows the abnormal patterns were higher in VKC than normal eye.

The maximal corneal power was significantly higher in VKC group than in control group (Table 4) only a small difference was detected between two eyes of each subject.

	Right	Left
VKC mean ± SD	45 ± 7.00	45.2 ± 6.3
Range	(40.2 - 59.01)	(40 - 60.01)
Control mean ± SD	41 ± 1.5	42 ± 2.0
Range	(39 - 45.2)	(38 - 46.05)
P	P = 0.001	P = 0.002

Table 4: *Corneal power in diopter in patients with VKC versus controls.*

In addition, VKC patients have significantly more corneal asymmetry than control subjects (Table 5).

	I-S index ≤ 1D	I-S index > 1D	Total
Right eye			
VKC	30 (60%)	20 (40%)	50
Control	50 (100%)	0	50
Left eye			
VKC	35 (70%)	15 (30%)	50
Control	47 (94%)	3 (6%)	50
P	0.003	0.002	

Table 5*: Corneal asymmetry among groups.*

It was also noted that subjects with VKC had thinner corneas than control (Table 6).

	Right	Left
VKC		
Mean ± SD	495 ± 80	494 ± 70
Range	480 - 530	485 - 520
Control		
Mean ± SD	530 ± 30	510 ± 20
Range	490 - 560	495 - 550

Table 6: *Corneal thickness among groups (p = 0.005).*

Of 100 eyes in 50 patients with VKC 9 eyes with keratoconus on topography were found. In Two patients, the findings were bilateral. In one eye, clinical signs for keratoconus: myopia, Vogt striae and positive Munson's sign were found.

Another 40 eyes had a topographic trend to keratoconus based on I-S index of more than 1.0D or maximal corneal power of more than 47.2D.

In control group, there were 3 patients with a suspected topographic trend to keratoconus. Non of the control subjects had a pattern of keratoconus corneal topography.

Discussion and Conclusion

Keratoconus in association with VCK is a commonly reported finding [10]. In a series of 530 cases of VCK examined with slit lamp biomicroscope and keratoscope. Khan., *et al*. reported a 7% incidence of keratoconus [18]. While Totan., *et al*. found that the incidence of keratoconus detected by Video keratography in VKC cases was 26.8% [8]. This higher incidence explained by the higher sensitivity of method used for screening keratoconus.

In this study, the incidence of keratoconus in association with VKC was 9%.

The male predominance in this study in VKC is in agreement with previous studies [17,18].

The role of chronic eye rubbing have been described in pathogenesis of keratoconus [19,20]. In VKC, eye rubbing is common because of complaint of intense itching. In this study, most of the VKC subjects frequently rubbed their eyes.

In this study, a comparison of videographic patterns in young. persons with VKC to normal controls. It was found that patients with VKC had significantly more abnormal corneal topographic patterns, higher maximal corneal dioptric power and increased I-S index. This is in agreement with other reports [15].

Barreto., *et al*. found that maximal corneal power was much higher in VKC group than in control group [22]. Also, Gortzak., *et al*. had also, found higher keratometric readings in children with VKC than in controls with mean central power of 44.9 D, 1 D flatter than reported by Barreto., *et al* [10]. In this study the mean corneal power in VKC was 45.1D.

Corneal topography correlated well with the numerical indices checked. This association was shown selectively by assessing the morphologic features of the topographical maps of these corneas and objectively by analyzing the outcomes of numerical indices in the same patients.

Rabinowitz., *et al*. found that 66.2% of normal corneas show patterns that are either round, oval or of symmetric bow-tie type [14].

In this study, it was found that 70% had normal pattern in topographic maps.

In VKC, these ratio were reversed, only 15% had normal pattern whereas 85% had abnormal pattern. The percent of irregular pattern in VKC was 5% while in control group was 2%, which is in concordance with the findings of Rabinowitz., *et al* [14].

Subjects with VKC had been shown to have thinner corneas than control. As occur in keratoconus, the stromal thinning is more frequent in VKC. Kim., *et al.* stated that chronic keratocyte apoptosis associated with ongoing epithelial injury may link risk factors associated with keratoconus progression such as chronic eye rubbing and VKC [21].

Also, Barreto., *et al*. found that patients with VKC had thinner cornea with abnormal pachymetric index than normal [22].

Nine eyes 9% with VKC had keratoconus on corneal topography as compared with non in the control group. Forty eyes of 30 patients had patterns with topographic trend to keratoconus as compared to 3 eyes of 3 patients in the control group. This higher incidence of keratoconus in VKC patient as compared with control in agreement with Dantas., *et al*. [24] who found that clinical diagnosis of keratoconus associated VKC was 9.82%

(7 patients), according to topographic criteria, the frequency increased to 22.53% (16 patients), while in control patients, no patients presented biomicroscopic, refractometric or topographic characteristics of keratoconus.

In summary, this study points out the importance of routine corneal topographic evaluation in subjects with VKC.

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