Abstract

Background: Subclinical Keratoconus is a term used to indicate a patient with inferior or central steepening of cornea on topography where the clinician suspects that it may progress to keratoconus.

Aim of the Study: Diagnosis of sub-clinical keratoconus among myopic patients seeking for correction of their refractive errors by excimer laser, to avoid surgery for those patients and consider them at risk of developing post operative corneal ectasia which is the most severe post operative complication in photorefractive surgery.

Patients and methods: One thousand and two hundred myopic patients who attended laser unit/ Hilla Teaching Hospital, during a 1.5 year duration, seeking for correction of their refractive errors. Many investigations were done including visual acuity, slit lamp examination, corneal topography, keratometry and pachymetry.

Results: Among those patients, 49 (4%) diagnosed as having subclinical keratoconus. Out of these (49) cases, (27) (55%) were males and (22) (45%) were females. Forty one (83.6%) of the patients where less than (25) years old.

Conclusion: Sub-clinical keratoconus is one of the challenging problems facing refractive surgeons and is one of the most important and preventable causes of corneal ectasia following photorefractive surgeries.
Introduction

Keratoconus is a progressive disorder in which the cornea assumes a conical shape secondary to stromal thinning and protrusion, [1] with an onset at puberty and progression over a period of (7 – 20) years [2, 3]. Keratoconus suspect, is a term used to indicate a patient with inferior or central corneal steepening on topography which may lead the clinician to suspect progression to keratoconus [4]. Early form of Keratoconus may go undetected unless anterior corneal topography is studied. Early disease is now best detected with videokeratography. Detecting early Keratoconus (sub clinical) in the absence of slit lamp findings has assumed increasing importance. In some instances, unpredictable results and patient dissatisfaction have been attributed to the existence of undiagnosed early Keratoconus in refractive surgery patients. Because these patients do not achieve high quality vision with either glasses or contact lenses, they tend to seek out refractive surgery. Recent reports suggest that patients with early Keratoconus or Keratoconus suspects comprise (2-5%) of patients presenting for refractive surgery for myopia. Videokeratography screening allows the clinician to rule out these early ectasias and other topographic abnormalities before embarking on refractive surgery [4].

The incidence of keratoconus ranges from (1.4--600) cases/year/100000 population [5- 8]

Most reports have considered that Keratoconus occurs in all ethnic groups [4], while some studies suggesting an influence of ethnic origin on the incidence and age of onset. [9, 10]

Subjects and Methods

One thousand and two hundred myopic patients attending the laser unit/Department of Ophthalmology/Hilla Teaching Hospital between November 2007 to June 2009 seeking for correction of their refractive errors by photorefractive surgery, were included in the study.

The patients were referred from primary care centers and private clinics. Among them 49 patients (27 males) and (22 females). Their age ranged between 18 – 34 years with a mean age (22.4) years were diagnosed as having subclinical keratoconus.

Full ophthalmological examination was performed including, visual acuity, refraction, keratometry, slit
lamp examination, corneal topography using OPD SCANII (NIDEK) and measuring of corneal thickness using pachymetry. In addition to medical history and associated ocular symptoms for patients with sub-clinical Keratoconus was documented.

Diagnosis of early or sub-clinical Keratoconus is made according to the following criteria:

Normal cornea on slit lamp biomicroscopic examination.

Scissoring of retinoscopic reflex or oil droplet sign.

Corneal topography findings: asymmetric bow tie with a skewed radial axis.

Pachymetric measurements.

These are extremely useful clinical signs to confirm the diagnosis of Keratoconus suspects as shown in the following photos.

**Figure 1** A keratoconic eye exhibits the typical topographic pattern of an asymmetric bow tie with a skewed radial axis. [19]

**Figure 2** The same topographic pattern seen in Figure (1) is evident in another case with early Keratoconus. [19]
Figure 3 An eye with sub clinical Keratoconus exhibits the same topographic pattern as the eyes shown in Figure (1). OPD SCANII (Nidek)

Figure 4 Inferior or central steepening on topography which may progress to Keratoconus. OPD SCANII (Nidek)

Quantitative data of distribution of patients according to sex and associated symptoms were evaluated by chi-square analysis. A p value of 0.05 was considered the upper limit of statistical significance.

Results

Results of this study shows that (49) patients had sub clinical Keratoconus {27, (55%) were males and 22, (45%) were females}. Chi square p = 0.835 (not significant). Forty one (83.6%) patients were less than 25 years old. (table I)

Table I Distribution of patients according to age and sex

<table>
<thead>
<tr>
<th>16 – 20</th>
<th>21 – 25</th>
<th>26 – 30</th>
<th>&gt; 30</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>14</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>15 (30.6%)</td>
<td>26 (53%)</td>
<td>7 (14.3%)</td>
<td>1 (2%)</td>
<td>0.835</td>
</tr>
</tbody>
</table>

Keratometric study shows that 20 (40.8%) patients are presented with keratometry readings below 47 diopeters and (24) (49%) between (47 - 50) diopeters and 5 (10.2%) with
keratometry readings more than 50.(table II)

**Table II** Distribution of patients according to keratometry readings

<table>
<thead>
<tr>
<th></th>
<th>&lt; 47 diopters</th>
<th>47 - 50 diopters</th>
<th>&gt; 50 diopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cases</td>
<td>20 (40.8%)</td>
<td>24 (49%)</td>
<td>5 (10.2%)</td>
</tr>
</tbody>
</table>

History and clinical examination reveals that (28) (57.1%) of patients presented with impairment of vision without associated symptoms and 10 (20.4%) presented with frequent eye rubbing and 11 (22.4%) presented with history of vernal kerato-conjunctivitis, eczema. and asthma. Chi square p = 0.105 (not significant)(table III)

**Table III** Distribution of patients according to associated symptoms

<table>
<thead>
<tr>
<th>No complaint</th>
<th>Frequent eye rubbing</th>
<th>Vernal kerato conjunctivitis</th>
<th>History of atopy (eczema + asthma)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 (57.1%)</td>
<td>10 (20.4%)</td>
<td>4 (8.1%)</td>
<td>7 (14.3%)</td>
<td>0.105</td>
</tr>
</tbody>
</table>

**Discussion**

Sub clinical Keratoconus or Keratoconus suspect present with no slit lamp findings, but the typical topography (asymmetric bowtie with a skewed radial axis) is present, with the aid of pachymetry, surgeons can detect the vast majority of keratoconic subtypes preoperatively and thus prevent ectasia. [4]

Our study showed that among 1200 myopic patients, 49 (4%) were diagnosed with early or subclinical Keratoconus and excluded from doing refractive surgery, the results are comparable with the results of other studies that showed patients with early or subclinical or Keratoconus suspect comprise (2% - 5%) of patients presenting for refractive surgery. [11]

The mean age of patients with subclinical Keratoconus was (22.4) years which is comparable with the results of other studies in Asia that varies between (20) and (23) years. [13, 8, 9] While other investigations on white population have reported higher mean age 27 years, suggesting later disease onset. [4, 8, 9] We found no significant differences among patients according to sex distribution as shown in table I, p = 0.835.

A considerable number of patients presented with subclinical Keratoconus (57.1%) had no history of allergy or associated symptoms, while (22.4%) of patients presented with either history of atopy (asthma, atopic dermatitis) or presented with vernal keratoconjunctivitis, while other previous studies had shown that 35% (15, 16) of those patients, and in Saudia Arabia only 16% of patients reported to have any form of atopy. [17]

So, there is no obvious relation between atopy and the occurrence of Keratoconus. (16, 18) p = 0.105 (not significant).
**Conclusions**

Subclinical Keratoconus is one of the challenging problem for refractive surgeons and it is one of the most important and preventable cause of corneal ectasia following photorefractive surgeries.

Therefore, with the aid of corneal topography, pachymetry, ocular examination and family history, early or subclinical Keratoconus can be diagnosed to avoid unpredictable results and patients dissatisfaction following refractive surgery, by excluding patients at risk for developing corneal ectasia post operatively.

**Acknowledgement**

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**References**


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