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ORIGINAL ARTICLE

Keratoconus and Its Effects on Visual Acuity: Early Diagnosis

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ABSTRACT

Keratoconus is an eye condition that is common in both eyes, with a prevalence of more than 1 in 1000 people. The analysis and diagnosis of the status of the keratoconus in the study consisted of an assortment of specialized medical apparatus which encompasses Auto Refractometer to measure the refractive errors, Penta Cam to create a three dimensional map of the corneal profile, Corneal Topography to identify the existence of an abnormality, a Slit Lamp to view the structure of the anterior eye, Visual Acuity Charts to measure the degree of vision impairment, and Optical Coherence Tomography (OCT) to image the corneal and retinal layers with high precision. A total of 139 patients diagnosed with keratoconus were subjected to clinical examinations, 117 of them were at the Al-Najaf Teaching Hospital, and 22 at the Samarra Hospital. The information was carefully recorded in terms of the disease progression, examination, and the level of visual impairment. It was found that the majority of patients have some visual impairment despite the degree of their acuity, which has a significant effect on the quality of their life, and the disease advancement is determined by the age, medical history, and extent of corneal deformation. Result: The outcome showed that Males (63.3%) were more affected by the kerokans than Females (36.7%), and the age group most likely to be affected is 20-30 (38.3%) of the entire number of patients. Eighty-two patients were right-eye affected (59% of the number of cases), and 57 patients were left-eye affected (41% of the number of cases). Penta Cam was the most used diagnostic method, with a percentage of 46.8, and Cross-Linking was the most used treatment method, with a rate of 46.

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1- INTRODUCTION

Keratoconus is an infrequent eye condition that is marked by progressive stromal atrophy and biomechanical instability resulting in conical cornea flaw and the violation of retinal photopic optics, manifesting as the impairment of clear vision. It is a disease that usually occurs in adolescence or early adulthood, has an insidious onset, and results in a severe impairment of visual function, which significantly lowers the quality of life [1]. Symmetry in the disturbance of the eyes often occurs in a bilateral form. In most cases, there is a tendency towards a dissymmetry where one eye is affected more than the other. Under severe conditions, optimum visual functioning,

especially visual acuity, may not be sufficiently recovered using spectacles or soft contacts, highlighting the need to recognize the incidences of visual impairments early enough and take other measures to ensure that adverse effects on the visual ability are avoided and that the visual capacity is maintained [2, 3, 4]. Keratoconus was first described in the year 1748 when the German doctor Burchhardt Mauchhardt, in his thesis Staphyloma Diaphanous, mentioned the syndrome. Further attempts to distinguish this entity among other corneal pathologies led the medical world to make use of the term in 1854; this was referred to as Konus keratinus [5, 6]. Modern evidence implies that the nature of keratoconus is a result of multiple factors, which occur as a result of the genetics cooperating with any environmental factors. Several researchers have explained the increasing incidence of the disease based on genetic abnormalities which mitigate the architecture of the cornea or stability of collagen like in Down syndrome [7, 8] The environmental stimuli include mechanical damage (habitually rubbed in the eyes) and forces of shear on the cornea, or, either a long-term exposure to ultraviolet radiation, tobacco smoke, and air pollutants, which lead to the occurrence of oxidative stress and stromal degeneration. The changing hormones throughout the pregnancy, as well as the alteration of the thyroid hormones, have also been cited to propagate the disease [9, 10].

Laser-assisted in situ keratomileusis (LASIK), ocular trauma, and precipitating and aggravating factors are known. Keratoconus is somewhat linear in its clinical evolution; the initial symptoms are usually mild and not specific, such as blurred vision, diplopia, photophobia, and accommodative strain. As the illness progresses, the patients are also prone to irregular astigmatism, distortion of visual images, pseudopodia, and halos [11, 12]. In difficult situations, visual loss can be so severe that actual blindness or that of a legal blindsight ensues at the point where medical intervention can only be restricted to corneal transplantation [13]. Among diagnostic modalities, it is possible to mention high-resolution three-dimensional corneal imaging (e.g., Penta Cam), corneal topography, refraction testing, slit-lamp, and optical coherence tomography that help to identify the disease at an early stage by defining the morphology of the cornea, psychophysical parameters of vision, and structural integrity [14, 15]. Therapeutic interventions are stage-specific. Preliminary measures are the use of spectacles or soft contact lenses, but more severe cases might involve rigid gas-permeable contact lenses or hybrid contact lenses. Collagen cross-linking is also used to prevent the course of the disease in the moderate to severe cases and to demand corneal transplantation at the end-stage pathology [16]. These clinical implications particularly apply, considering the high levels of visual impairment, which are accompanied by the loss of quality of life associated with keratoconus. Research in the scientific community still focuses on ensuring that they become clinically more insightful regarding their pathophysiology, the better detection of risk factors, and better quality of diagnosis and treatment to guarantee the best patient outcomes, as far as visual dysfunction is concerned [17, 18, 19].

This study aims to assess the clinical and morphologic characteristics of patients with keratoconus based on the advanced diagnostic systems, e.g., Pentacam, corneal topography, the tests of visual acuity, and OCT. It also explores how demographic and clinical factors contribute to the development of the diseases and how the treatments are effective, with a particular focus on the importance of a timely diagnosis to better patient outcomes and quality of life. The results will be designed to improve clinical knowledge and the process of diagnostic and treatment of the condition of keratoconus.

2- MATERIALS AND METHODS

2.1 Instruments that will be used in the study:

There was also a thorough set of special ophthalmic equipment used to assist in the examination and diagnosis of keratoconus. The tools that were used are listed as follows:

1. Auto Refractometer: It was used to measure optical refractive errors and, therefore, help identify irregular astigmatism and myopia that is very common in patients with keratoconus [20].

2. Penta Cam: This is a 3D map of the cornea that produces a Penta Cam Cornea, which is of great use in the evaluation of the corneal curvature, thickness, and topographical anomalies, thus helping to monitor the progression of the disease [21].

3. Corneal Topography: The corneal topography mode is capable of giving a very accurate topographical analysis of the corneal surface, allowing the ability to detect local steepening and anomalies typical of keratoconus [22].

4. Slit Lamp Biomicroscope: This is used to perform the complete clinical examination of the anterior segment, such as the cornea, lens, and anterior chamber, which helps in detecting the slightest morphological changes that might indicate keratoconus [23].

5. Visual Acuity Charts: Visual acuity charts were applied, which are standard checklists of visual acuity, to assess visual acuity and determine the level of its limitation that is linked to keratoconus [24].

6. Optical Coherence Tomography (OCT): OCT is a high-quality scans of the corneal thickness and structural integrity, which is highly non-invasive, a check-up of corneal layers and the retina-related parameters in order to stage keratoconus [25].

2.2 Research Methods and Study Design

2.2.1 Study Population and Ethical Considerations

Across-sectional descriptive study, involving 139 patients with a clinical diagnosis of keratoconus (117 of whom were referred to Al-Najaf Teaching Hospital and 22 to Samarra Hospital. The inclusion criteria were a proven diagnosis of keratoconus using corneal topography or other diagnostic methods, and patients with ocular comorbidities besides keratoconus were excluded because these associations could confound the results.

2.2.2 Clinical Investigation and Collection of Data

Experienced optometrists and ophthalmologists systematically conducted clinical evaluations. All patients were thoroughly evaluated with the instruments above. Clinical patient demographics, disease stage, visual acuity, and history of treatment were collected in structured case report forms developed for this study.

2.2.3 Data Analysis

The research team did data collection and entry; continuous monitoring of all the data was provided. The patient demographics, clinical parameters, and the distribution of diagnostic tools and treatment were reported as descriptive statistics. The analysis was based on the correlation between the patient features (age/gender/disease stage) and the clinical outcomes. The alterations of the evolution of the keratoconus were evaluated concerning the corneal deformity and history. [Statistical software name, version] was used to perform statistical analyses with a significant level of $p < 0.05$.

23 Limitations

Possible drawbacks include differences in calibrating devices among centres and differences among observers in clinical assessments. Moreover, the cross-sectional design restricts causal inference regarding the disease progression dynamics. Standardized protocols and calibration procedures protected from these factors, but must nonetheless also be considered for interpreting findings from the studies.

3- RESULTS AND DISCUSSION

The number of participants was 139. The youngest age group was 10 years old, and the oldest was 60 years old, as shown in the tables below.

N = 139
LOWER BOUND OF A CLASS = 10 (Xs)
UPPER BOUND OF A CLASS = > 60 (X c)
TOYAL REUSE (TR) (Xc -Xs) +1 = (60 -10) + 1 = 51
NUMBER OF CLASS= 1+ 3.32 Log N = 1 + 3.32 Log 139 = 6.46
LENGTH OF A CLASS:
L = TR / M = 139 / 6 = 23

The result indicates that Males accounted for 63.3% of the participants, whereas Females represented 36.7% of the total.

Table (1): Patients' results according to gender

GENDER GROUP	PATIENTS	%
Male	88	63.3
Female	51	36.7
Total	139	100

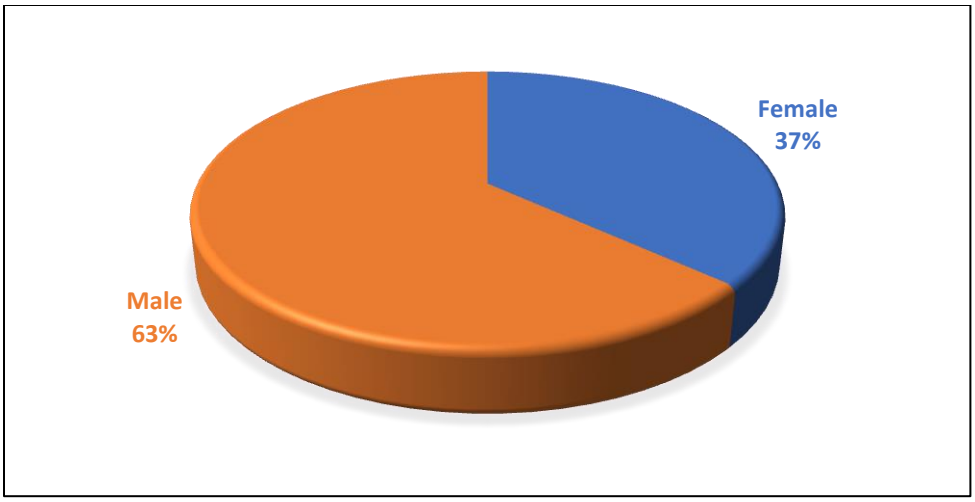

Fig (1): Patient's result according to gender

Based on examinations of 139 patients, it was found that the age group most affected by keratoconus is 20-30% (38.3%), more than the other groups as shown in Table 2.

Tables (2): Patients' results according to age groups

AGE GROUP	PATIENTS	%
10 – 20	22	15.8 %
20 – 30	54	38.3 %
30 – 40	32	23 %
40 – 50	19	13.6 %
50 – 60	6	4.3 %
≤ 60	6	4.3 %

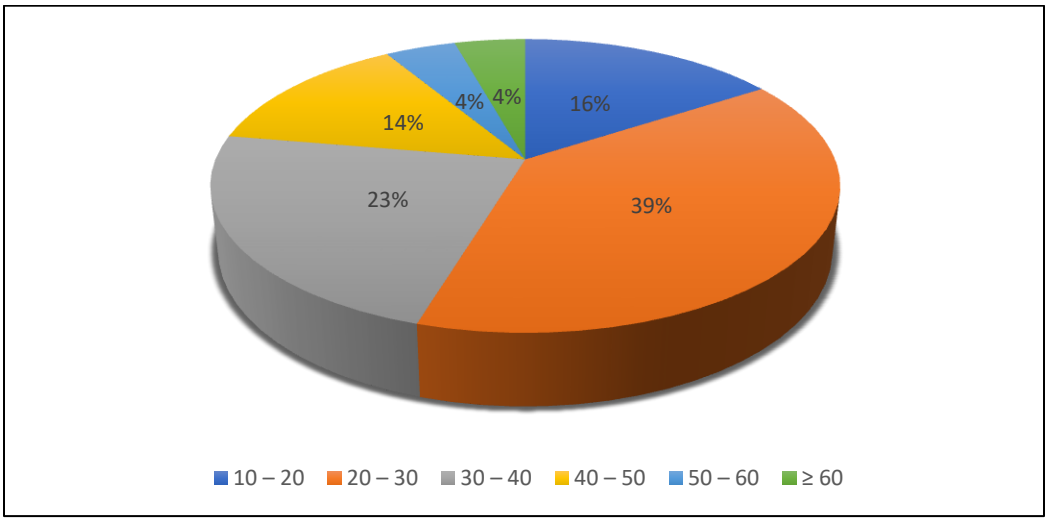

Fig (2): Patients' results according to age groups

From Table 3, the study found that 82 patients had the right eye affected (59% of cases), while 57 patients had the left eye affected (41% of cases).

Table (3): Patient's result according to eye infection

EYES INFECTION	PATIENTS	%
The right eye	82	59
The left eye	57	41
Total	139	100

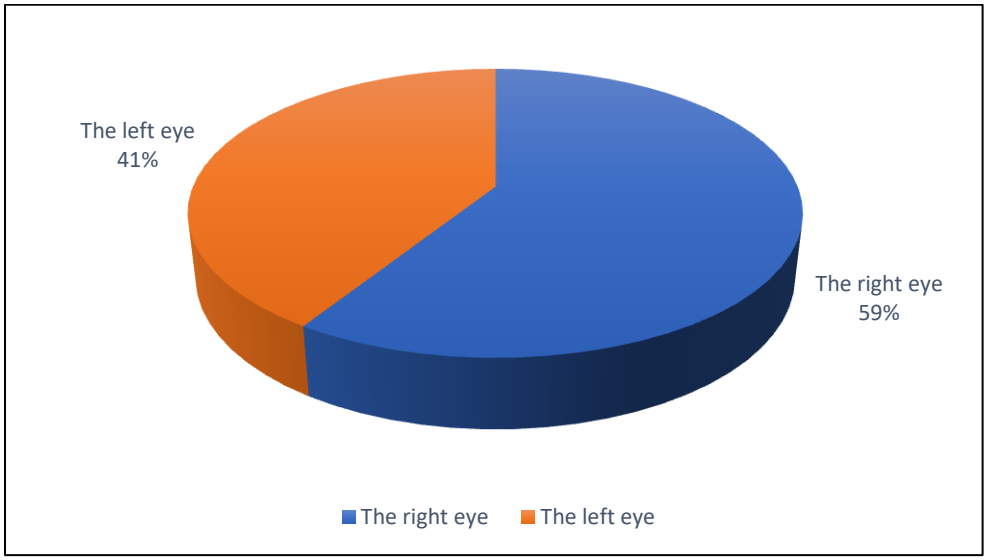

Fig (3): Patient's result according to eye infection

Based on Table 4, the most commonly used diagnostic method was Penta Cam, with a percentage of 46.8%.

Tables (4): Patients' results according to the method of diagnosis

METHOD OF DIAGNOSIS	PATIENTS	%
PENTACAM	65	46.8 %
TOPOGRAPHY	38	27.5 %
AUTOREFRACTOMETER	21	15 %
OCT	15	10.7 %

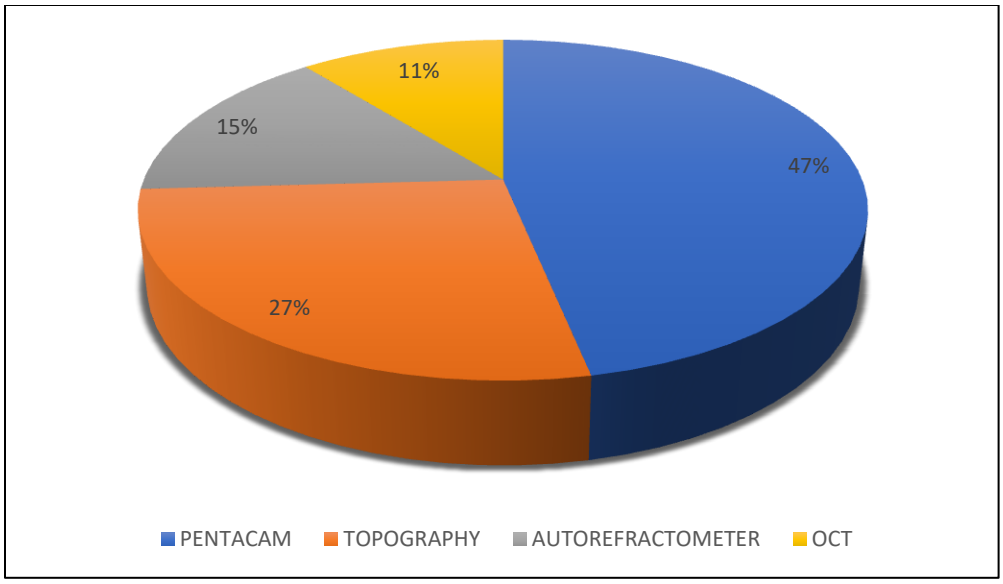

Fig (4): Patients' results according to the method of diagnosis

Based on Table 5, the most commonly used treatment method was Cross-Linking, with a percentage of 46%.

Table (5): Patients' results according to the treatment

TREATMENT	PATIENTS	%
CROSS-LINKING	64	46 %
RGP	6	4.3 %
GLASSES	41	29.5 %
CONTACT LENS	17	12.2 %
CORNEAL TRANSPLANTATION	11	7.9 %

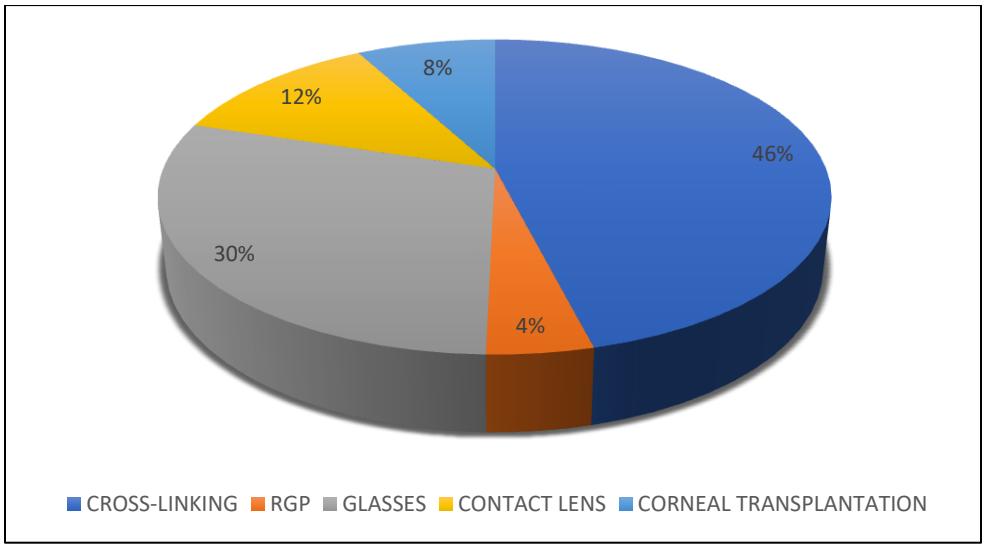

Fig (5): Patients' results according to the treatment

In a study conducted on 139 patients with a diagnosis of keratoconus in Al-Najaf Teaching Hospital and other governorates, it was found that the cornea is a product of both genetic influences and environmental factors, whereby individuals are constantly rubbing their eyes. Most of the patients reported a high level of visual acuity, and that is why early diagnosis and intervention should be used to improve the level of treatment.

Breaking down the patient data:

- 117 patients were examined at the German Hospital in Najaf.
- 22 patients were reviewed at Samarra General Hospital.

The outcomes suggest that the timely diagnosis is an essential part of the treatment process because patients who receive a medical assessment promptly demonstrate improved reactions to the therapeutic measures. The research states that there is a necessity to develop awareness about precaution measures and reducing risk factors, such as rubbing the eyes often, which is another measure that enhances the development of diseases.

In addition, the statistical figures in the tables provide an in-depth examination of the status of every patient, which justifies the relevance of tailored treatment plans based on the severity and progression of a disease.

4- CONCLUSION

The tests were carried out on patients with keratoconus at the German Hospital in Najaf and Samarra General Hospital, where 117 and 22 patients, respectively, were used in the tests. The research was conducted to assess the connection between the patient's age and the kind of treatment to use in the specific case. The results were that the sooner the diagnosis was made, the more effective the treatment was. Age and Gender Distribution: The outcome revealed that there were 74 male patients who constituted 63.3 percent of the total number of patients, whereas 43 female patients constituted 36.7 percent. This implies that the condition can be more susceptible to males, and this might be due to genetic or environmental factors.

Eye Infection Distribution: The researchers discovered that the right eye was impacted in 72 patients (59% of cases), and the left eye was affected in 49 patients (41% of cases). This implies that it is possible that the right eye is more affected, which is the reason why more research is required on the causes of such a distribution. Effect of Early Diagnosis or Response to treatment: It was noted that the patients with earlier diagnosis and treatment responded better to treatment than those patients who were diagnosed later. The discovery emphasizes the need to analyze the patient at an early stage, as early intervention could have a significant impact on the prognosis and quality of life of the patient.

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