



## Changes in keratometry readings and Pterygium induced astigmatism after Pterygium excision

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### ABSTRACT

Pterygium can cause deterioration of vision by distortion the corneal smooth surface, and so induce astigmatism usually with the rule type, which is reversible by Pterygium excision surgery So the aim of this study to evaluate prospectively, the change in keratometric readings and corneal refractive status after pterygium excision surgery a case series study (117 eyes). It was carried out over a period of 9 months from 1<sup>st</sup> month of 2018, for patients were admitted to the departments of ophthalmology at Najaf city. All patients underwent preoperative optometric assessment. All data collected preoperatively then one month postoperatively. Data analysis and comparison then performed. The findings of this study were that Pterygium is more prevalent in males than females, (81% to 19%), and more prevalent in young to middle-aged people between (30-45 years 59%), grade II (45%) are presented. This study also found that keratometric (K1,K2) readings in all grades are significantly reduced postoperatively. Astigmatism associated with pterygium at all grades also showed significant improvement. This improvement also applied to visual acuity, which improves in (64%) one month postoperatively. We conclude that Pterygium excision, associated with significant improvement in refraction and keratometric readings. And we suggested for eye protection should be considered, when spending a long time work outdoor, like proper polarized and UV filter sunglasses, also if possible avoid work outdoor during sunny and hot days. Surgical excision of Pterygium in the early stages will result in better visual rehabilitation.



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### INTRODUCTION

The growing of fibro vascular triangular sub - epithelial tissue that represents degenerated conjunctival tissue crossing limbus and the corneal surface is called Pterygium. (Jack and Kanski, 2007). It is a common condition that mostly distributed in the nasal part of palpebral fissure more than the temporal side and extended more over the cornea. (<http://eyewiki.aao.org/Pterygium>). Pterygium main effect on vision by inducing with the rule astigmatism that can be explained by pooling of tears at the edge of it or Tractional effect by tissue on the cornea (Hansen and Norn, 1980; Ergin and Bozdo-

gan, 2001; Kadayifcilar *et al.*, 1998). The grading of Pterygium done by examination by slit lamp, while grade one when as Pterygium cross limbal area but not reaching pupil while grade two when extend to a pupil and stage three when Pterygium is crossing the pupil to another side. (Saleem1 and Saleemchanar2, 2011). Pterygium explanations for development still carry some uncertainty the incidence in the hot and dry environment suggested the rule of UV light that might stimulate fibroblast proliferation and result in extra tissue growth that leads to Pterygium. ( (<http://eyewiki.aao.org/Pterygium>), others factors such as choline deficiency, dis-regulation of angiogenic factors, abnormalities of immune system and sometimes viral antigenic effects suggested by researcher ( <http://eyewiki.aao.org/Pterygium> ). Clinically Pterygium usually the small one are asymptomatic but sometimes grittiness and irritation might be presented or some patient will not tolerate the contact lens wearing or even interfering with visual Pathway or cosmetic appearance in a higher grade. ( <http://eyewiki.aao.org/Pterygium>). The physical signs are mainly the triangular fibro vascular growing conjunctival tissue that extend over the cornea and limbus and sometimes may be thin translucent membrane with elevated mound generally is most common in nasal but may occur in temporal or both sides ( <http://eyewiki.aao.org/Pterygium>).

### Aims of study

To evaluate prospectively the change in keratometric readings and corneal refractive status after pterygium excision surgery.

### PATIENTS AND METHODS

The study was carried out on 117 eyes of 117 patients with primary pterygium.

All patients underwent preoperative assessment for visual acuity (using Snellen's chart), anterior segment examination, posterior segment examination using Slitlamp bio-microscopy with condensing lens, refraction and keratometry (K1 is Corneal curvature at the flat meridian and K2 is Corneal curvature at steep meridian) using auto refractometers that were of different manufacturers in the three hospitals. A case series study, approval was taken from the local ethical committee. Verbal consents were obtained from all patients prior to participation and surgical intervention. Data of the patients were kept confidentially; names and any data that identify the patients were secured and replaced with codes. The study was carried out over a period of 9 months from 1<sup>st</sup>, January 2018 to 30<sup>th</sup>. September 2018, for patients who had pri-

mary pterygium and were admitted to the department of ophthalmology at Al-Sadder teaching hospital, Al-Hakeem general hospital, and AL-Furat teaching hospital at Najaf city. Data were collected by using a pre constructed data collection sheet, through interview with the patients, full medical and surgical history taking and complete clinical examination. All data collected preoperatively, then one month postoperatively, All patients have been asked to give information about, name, age, occupation, cause behind presentation, where occupation considered as indoor and outdoor, the indoor occupations are (writer, secretary, office employee, tailor, housewife, teacher.etc.), while outdoor occupations include ( building worker, taxi driver, seller, fisherman, welding man...etc.). Cases were grouped according to the extent of pterygium into three groups, group1 (grade I); group 2 (grade II); and group 3 (grade III).

Statistical analysis of data of the 117 patients were, managed and analyzed by using the statistical package for social sciences (SPSS) software for windows 10 education, version 1803, MS. Office 2010. Statistical description was presented as frequencies (numbers), proportions (%), mean  $\pm$  standard deviation (SD). Appropriate statistical tests were used to assess the significance of differences of refraction and corneal curvature pre and post- surgical excision of Pterygium, Chi square test was used to compare frequencies, while paired *t*-test was used to compare means, level of significance (P. value) of  $\leq 0.05$  indicated a statistically significant difference or correlation. Finally, the results and findings were presented in tables and figures. All patients were operated for pterygium by Simple excision ('bare sclera' technique) ) Duke-Elder S. Diseases of the Outer Eye Part 1. (Inclusion criteria: Only those patients with primary Pterygium were included in the study. Exclusion criteria: Preexisting corneal pathology like traumatic or surgical corneal scar, corneal dystrophies or ectatic corneal disorder, pseudopterygium (band of conjunctiva adhering to an area of compromised cornea at its apex) (Bowling, 2016) (recurrent pterygium, patients not consenting for pterygium excision.

### RESULTS AND DISCUSSION

The distribution number and percentage of pterygium according to gender and outdoor, indoor occupation, as shown down in Table 1,

The study revealed that pterygium is more prevalent in males than in females, as it found in (81%) of males and only (19%) of females, where (88%) of males are outdoor workers, while only

**Table 1: Distribution number and percentage of pterygium according to gender and outdoor, indoor occupation.**

| Gender                           | Outdoor  | Indoor   | Total NO. (%) |
|----------------------------------|----------|----------|---------------|
| Male NO. (%)                     | 84 (88%) | 11 (12%) | 95 (81%)      |
| Female NO. (%)                   | 4 (18%)  | 18 (82%) | 22 (19%)      |
| Total NO. (%)                    | 88 (75%) | 29 (25%) | 117 (100%)    |
| Indoor, outdoor P value (0.0005) |          |          |               |

**Table 2: Distribution according to number and percentage of pterygium according to age and outdoor, indoor occupation**

| Age of patient | Outdoor NO. (%) | Indoor NO. (%) | Total NO. (%) |
|----------------|-----------------|----------------|---------------|
| 30-45 years    | 64 (93%)        | 5 (7%)         | 69 (59%)      |
| 46-61 years    | 22 (58%)        | 16 (42%)       | 38 (32%)      |
| > 61 years     | 2 (20%)         | 8 (80%)        | 10 (9%)       |
| Total. NO. (%) | 88 (75%)        | 29 (25%)       | 117 (100%)    |

**Table 3: Percentage of patients in each grade of pterygium.**

| Grade | NO. of patients | Percentage |
|-------|-----------------|------------|
| GI    | 45              | 39%        |
| GII   | 53              | 45%        |
| GIII  | 19              | 16%        |
| Total | 117             | 100%       |

**Table 4: Pre and post operative mean K readings at each grade of pterygium.**

| Grade of pterygium | Mean K1(D) ( $\pm$ SD) |                  | Mean K2 (D) ( $\pm$ SD) |                  |
|--------------------|------------------------|------------------|-------------------------|------------------|
|                    | Preoperative           | Postoperative    | Preoperative            | Postoperative    |
| GI                 | 42.85 $\pm$ 0.59       | 42.48 $\pm$ 0.38 | 43.24 $\pm$ 0.34        | 42.65 $\pm$ 0.25 |
| GII                | 43.39 $\pm$ 0.41       | 43.11 $\pm$ 0.49 | 44.31 $\pm$ 0.89        | 43.48 $\pm$ 0.36 |
| GIII               | 44.04 $\pm$ 0.25       | 43.27 $\pm$ 0.60 | 46.26 $\pm$ 1.26        | 43.91 $\pm$ 0.92 |
| Total              | 43.43 $\pm$ 0.67       | 42.95 $\pm$ 0.60 | 44.70 $\pm$ 1.54        | 43.35 $\pm$ 0.79 |
|                    | P value (0.001)        |                  | P value (0.00001)       |                  |

**Table 5: Preoperative and postoperative astigmatism with grades**

| Grade     | Preoperative mean astigmatism (D $\pm$ SD) | Postoperative mean astigmatism (D $\pm$ SD) |
|-----------|--|---|
| Grade I   | 0.39 $\pm$ 0.07                            | 0.04 $\pm$ 0.11                             |
| Grade II  | 0.92 $\pm$ 0.30                            | 0.19 $\pm$ 0.15                             |
| Grade III | 2.22 $\pm$ 0.57                            | 0.23 $\pm$ 0.03                             |
| Total     | 1.04 $\pm$ 0.80                            | 0.16 $\pm$ 0.09                             |
|           | P value (0.016).                           |   |

**Table 6: Distribution of visual acuity pre and postoperatively in respect to each grade of Pterygium**

| Grade     | Visual acuity (VA)   |         |         |           |                      |         |       |           |
|-----------|----------------------|---------|---------|-----------|----------------------|---------|-------|-----------|
|           | Preoperative VA/ NO. |         |         |           | Postoperative VA/NO. |         |       |           |
|           | 6/6                  | 6/12    | 6/18    | 6/24-6/60 | 6/6                  | 6/12    | 6/18  | 6/24-6/60 |
| GI        | 12                   | 26      | 7       | 0         | 39                   | 3       | 3     | 0         |
| GII       | 0                    | 25      | 27      | 1         | 35                   | 16      | 2     | 0         |
| GIII      | 0                    | 8       | 9       | 2         | 1                    | 13      | 4     | 1         |
| Total (%) | 12(10%)              | 59(50%) | 43(37%) | 3(3%)     | 75(64%)              | 32(27%) | 9(8%) | 1(<1%)    |

(18%) of females are outdoor worker, and found that it's occurrence was statistically significant between indoor and outdoor workers, as p-value was (0.0005). Similar finding consistent with that of a study conducted by Syed Imtiaz (Shah et al., 2016). Also, this result found on the study conducting by (Al-Bdour and Al-Latayfeh, 2004). As they found that there is a statistically significant association between outdoor work, sunlight exposure and pterygium formation. So we can conclude that pterygium is more common in males and sunlight and hot weather are important contributing factors to cause pterygium. The distribution of numbers and percentage of pterygium according to age and outdoor, indoor occupation, detailed down in Table 2. It shows that pterygium is present in 69(59%) of cases in age group of 30-45 years, where 64 (93%) of them are outdoor workers. Followed by 38 (32%) in age group 46-61years, 22 (58%) of them are outdoor workers, and least common 10 (9%) in ages more than 61 years only 2 (20%) of them are outdoor workers. From this table we can see that the overall outdoor workers form (75%) of the total sample , and shows that pterygium is more common in 30-45 age group people who are more exposing to external environment, and found statistically significant among those outdoor workers, than indoor for all age groups, as p value was (0.002). This finding consistent with that of a study conducted by (Prabhakar, 2014). As found that the younger to middle age seem to be vulnerable for the development of pterygium, probably because of their increased outdoor occupations for prolonged time. Also this result found by (Sahay et al., 2017).

Percentage of patients in each grade of pterygium were shown down in Table 3. Patients in grade II are more presented in our sample with a percent of (45%), followed by patient of grade I with percent of (39%), and the least patients with grade III (16%). This result was consistent with that of a study conducted by (Ribeiro et al., 2011).

Concerning pre and postoperative mean K readings at each grade of pterygium as demonstrated in Table 4. The study shows that, as the pterygium increases in its extent from limbus towards pupil the value of K2 increases. In grade I mean K2 was (43.24± 0.34SD), grade II mean K2 was(44.31 ±0.89 SD), and grade III mean K2(46.26 ±1.26SD), with a mean value of K2 (44.70± 1.54), indicate that the meridian become steeper, and pterygium induced more cylindrical effect. The value of K1 increases also with the advanced grade of pterygium, but to a lesser extent than in K2. In grade I mean K1 value was (42.85±0.59), grade II mean K1 (43.39± 0.41), and in grade III mean K1 was (44.04± 0.25) resulting a mean K1 value preoperatively of ( 43.43±0.67SD). Post operatively as the effect of the pterygium tissue upon horizontal meridian decreased, K1and K2 values start to be lesser than preoperatively, and their values start to be near equal, means astigmatismic effect of pterygium became minimum. Where mean K1 in grade I became (42.48±0.38SD), in grade II (43.11± 0.49SD), and in grade III mean K1 decreased to (43.27± 0.60SD), with a mean reduction in K1 postoperatively (42.95 ±0.60). K2 value also started to decreases postoperatively, where mean value in grade I became (42.65 ±0.25SD), mean K2 in grade II became (43.48± 0.36SD), and in grade III (43.91 ±0.92SD), resulted in mean K2 value postoperatively of (43.35±0.79). We found that, the reduction in K values were statically significant, as P values were (0.001), (0.00001) for postoperative K1, K2 respectively. Similar result found by (Meitei et al., 2016).

Changes in astigmatism, Table 5 shows preoperative and postoperative astigmatism with grades. As the pterygium grows towards pupil, the amount of astigmatism will increase. Also depend on the grade of pterygium , we can see a decrease in the amount of astigmatism one month post operatively, in grade I it decreased from (0.39D ± 0.07SD) to (0.04D ±0.11SD), in grade II the amount

of astigmatism reduced from  $(0.92D \pm 0.30SD)$  to  $(0.19D \pm 0.15SD)$ , in grade III amount of astigmatism decreased from  $(2.22D \pm 0.57SD)$  to  $(0.23D \pm 0.03SD)$ , finally the mean preoperative astigmatism reduced from  $(1.04D \pm 0.80SD)$  to  $(0.16D \pm 0.09SD)$  one month post operatively, and found that is a statistically significant, as P value was (0.016). This result also found by (Lindsay and Sullivan, 2001) their study concluded that Subsequent excision of the pterygium brought about a reversal of the pterygium-induced corneal astigmatism, (P and Jain, 2016) have found that the astigmatism decreased significantly following Pterygium excision, the mean preoperative refractive cylinder decreased from  $3.12D \pm 2.02$  to  $1.43D \pm 1.24$  postoperatively ( $p \leq 0.001$ ) depending on grade of pterygium. (Yousuf, 2005) also found that the astigmatism decreased significantly following pterygium excision, and the mean preoperative refractive astigmatism decreased from  $(4.32 \pm 1.88 D)$  to  $(2.11 \pm 1.96 D)$ .

Improvement of visual acuity, Table 6 shows the distribution of visual acuity pre and postoperatively in respect to each grade of pterygium. Preoperatively 59(50%) patients of the study sample were had visual acuity (6/12), and 43(37%) patients were had visual acuity (6/18). Postoperatively (75) patients constitute about (64%) returned to (6/6), while (32) patients constitute about (27%) returned to (6/12), and together form about (91%) of the sample regained good visual acuity. That indicates clinically significant improvement in the visual acuity post pterygium excision

So Pterygium is a wing-shaped ocular surface lesion traditionally described as an encroachment of bulbar conjunctiva onto the cornea (S., 1965) it causes localized flattening central to the apex of the Pterygium (Pavilack and Halpern, 1995). As this flattening is along the horizontal meridian, it usually causes with-the-rule corneal astigmatism, (Buratto, 1996) although pterygium is generally regarded as a benign and cosmetic concern, without proper treatment, it may result in significant visual morbidity or even potentially blindness in extreme stages. (Gazzard et al., 2002; Durkin et al., 2008) In the current study we depended a month as a last determinant reading, because 30 days period is enough to stabilize the refraction postoperatively, as this result found in the study conducting by (Chourasia et al., 1996) By history, most patients with grade I were presented due to cosmesis, or because of tear film instability that lead to dry eye symptoms, although autorefractometry revealed that they had some degrees of astigmatism, It has been postulated that the cause of the astigmatism associated

with pterygium is tear film pooling at the apex of the pterygium (Oldenburg et al., 1990) majority of grade II patients were presented due to astigmatism beside causes mentioned in grade I, grade III patients presented mainly due to astigmatism, and they are the least because of two reasons, one because pterygium needs more time to reach this grade, second most of patient were treated it at grade I or II. Our study found that there is a direct proportion between the grade of pterygium and the amount of astigmatism, where the mean value was  $(0.39D \pm 0.07)$  in grade I,  $(0.92D \pm 0.30)$  in grade II, and  $(2.22D \pm 0.57)$  in grade III. Similar result was found with study conducted by (Maheshwari, 2007) he found that, Grade II or larger pterygium was associated with increase in astigmatism, also a study conducted by (Lindsay and Sullivan, 2001; P and Jain, 2016) they found that there was statistically significant correlation between grade of pterygium and induced astigmatism ( $p$ -value  $\leq 0.001$ ). This result also found by (Shrivastava et al., 2017) they concluded that there is a significant reduction in pterygium induced astigmatism and improvement in visual acuity on surgical removal of the pterygium. A similar result found in the study conducted by (Shelke et al., 2014).

## CONCLUSIONS

Pterygium is more common in males than in females. Outdoor occupation is an important cause of pterygium. Most of patient have pterygium, are present due to decrease in their vision quality. Astigmatism and decrease in visual acuity induced by pterygium, is reversible, and reduced after pterygium excision.

## Recommendation

Protection should be considered, when spend long time work outdoor, like proper polarized and UV filter sunglasses, also if possible avoid work outdoor during sunny and hot days. Surgical excision of pterygium in early stages to get better visual rehabilitation

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## Conflict of interest

None

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