

# A Clinical Study to Evaluate the Refractive Errors Associated with Different Types of Cataract

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**Abstract:** *Refractive errors in different types of Cataract. Introduction: It's well-known that nuclear cataract causes myopic shift though the effect of cortical and posterior subcapsular (PSC) cataract on refractive error is vague. The intention of this study was to find out the effect of the different morphological types of age related cataract on refractive errors. Aim: To determine the effect of the three main morphological types of cataract on the refractive status of the eye in Libyan patients. Objectives: assessment of the refractive status in three groups of patients each with only one of the main three types of age related cataract and the prevalence of refractive errors in a randomly selected group of individuals with no cataract. Material and methods: fifty five patients attending the Eye Hospital- Benghazi and with only one type of cataract were included in the study, 58 subjects with no previous ocular disease and with no cataract were included as a control group. All patients had a refraction test to determine the refractive status of the eye and both spherical and astigmatic elements were noted. Conclusion: about three quarters of patients with age related cataracts showed significant astigmatic refractive errors compared to 10% of the control group and nuclear cataracts showed myopic shift but only with astigmatic changes and cortical cataract was associated with astigmatic shift.*

**Keywords:** cataract, Benghazi, refractive errors.

**Key messages:** astigmatism was the most prevalent refractive error associated with cataract, small sample size, no pure myopic shift with nuclear cataract.

## 1. Introduction

The ancient Greeks and Romans claimed that lens was the part of the eye responsible for the faculty of seeing (1) in fact it's only a part of the visual system. Cataract is a very common cause of visual impairment in older adults with three different types (nuclear, cortical and posterior subcapsular) the pathogenesis of which is progressive multifactorial and not completely understood. Nuclear cataract often causes changes in the refractive index of the lens and thus a myopic shift, whereas in hyperopic eyes, the myopic shift enables presbyopic individuals to read without spectacles, a condition referred to as second sight (2). The symptoms that a particular type of cataract produces in a patient's vision are not the same and depend on the type and grade of maturity of the cataract.

The effect of cortical and posterior subcapsular (PSC) cataract on refractive error is less clear. Planten (3) suggested that cortical opacity can induce hyperopic shifts. Previous studies have suggested that cortical opacity can induce astigmatic changes, but all were a clinical evaluation data with no clear data. The purpose of this study is to determine the effect of the main morphological types of age related cataract on refractive errors.

## 2. Aim

To determine the effects of the morphological types of cataract on the refractive status of the eye in a sample of Libyan patients.

## 3. Objectives

- To assess the refractive status in three groups of patients each with only one of the main three types of age related cataract
- To assess the prevalence of refractive errors in a randomly selected group of individual with no cataract

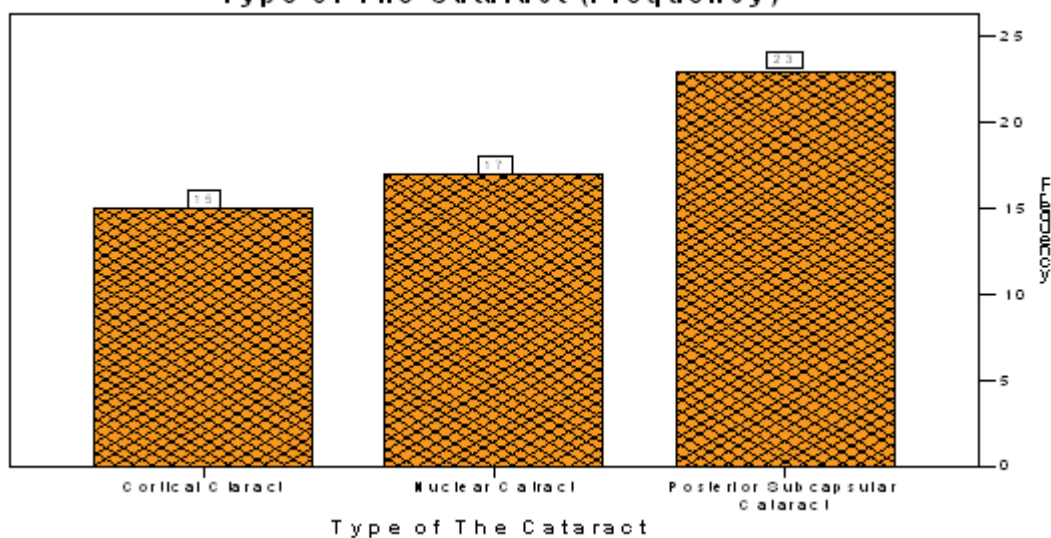
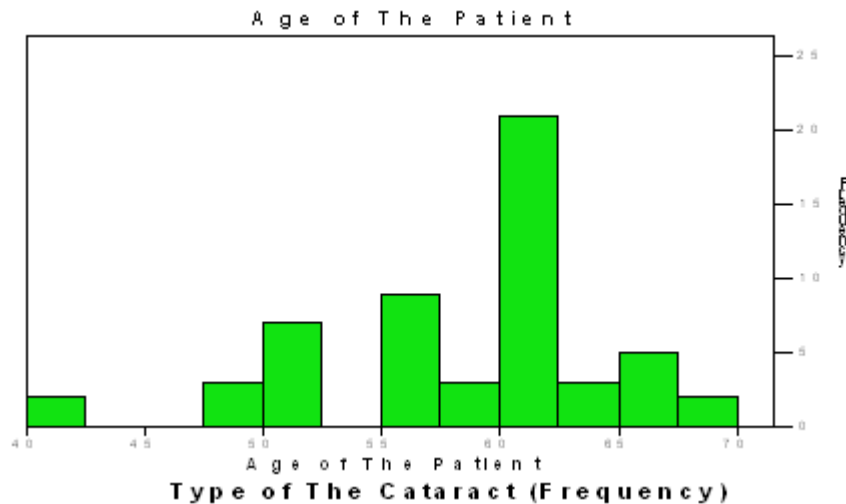
## 4. Material and methods

- Fifty five patients attending the Eye Hospital- Benghazi and diagnosed with only one type of cataract were included in the study, as of the lack of the modern cataract grading systems, all patients underwent dilated examination who confirmed the diagnosis, by the same senior surgeon who further did their surgery.
- 58 subjects with neither previous ocular disease nor cataract were included as a control group to evaluate the different refractive errors in healthy subjects.
- All patients' refractive errors were tested to determine the refractive status of the eye, spherical and the astigmatic elements (elements of lenticular astigmatism was only included by means of keratometry and biometry measurement) of the any refractive errors were noted.

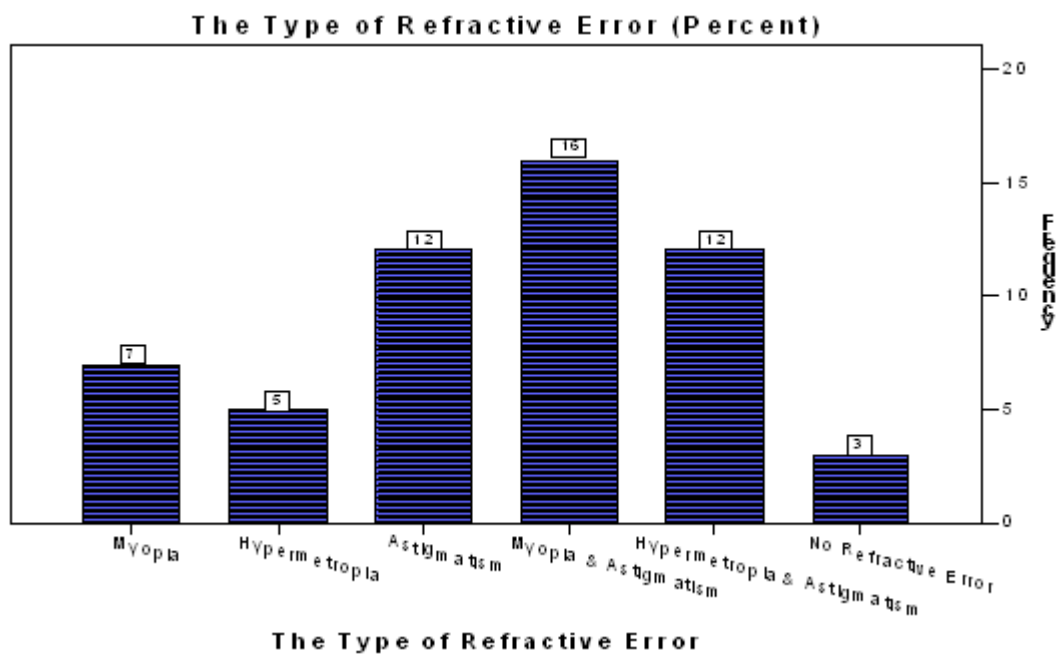
## 5. Results

The cataract group:

- 55 patients were included; 22 were males and 33 were females. Their age ranges 42 – 70 yrs; the mean age was 57.9 years (SD 6.2). The prevalence of cortical cataract was 15 (27.3%), 17 (30.9%) had nuclear cataract, and 23 (41.8%) had posterior sub capsular cataract.



- Of all the 55 cataract patients 72.7% showed astigmatic error, 12.7% showed myopic error and 9.1% showed hypermetropic error.



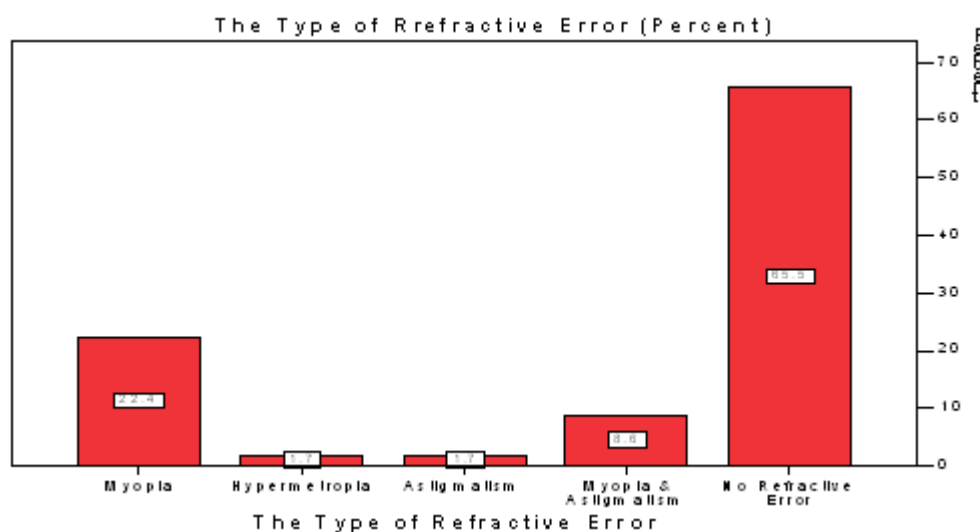
Type of cataract	The Type of Refractive Error						total
	Myopia	hypermetropia	astigmatism	myopic astigmatism	Hypermetropic astigmatism	No refractive errors	
Cortical cataract	2	2	4	2	5	0	15
Nuclear cataract	0	0	6	6	4	1	17
Posterior subcapsular cataract	5	3	2	8	3	2	23
Total	7	5	12	16	11	3	55

#### Subgroup analysis:

- Cortical cataract was associated with astigmatic errors
- Nuclear cataract was associated with astigmatism, myopic astigmatism.
- Posterior subcapsular cataract was associated with more myopic astigmatism and myopic shift.

#### The control group

- 58 subjects were included in the study 22 males and 36 females. Their age range 13 -38 years; mean age 23.2 years (SD 4.3). 65.5% of the subject had no refractive errors and 34.5% had significant refractive error (>0.5 D); 22.4% had myopic errors, 10.3% had a stigmatic errors, 1.7% had hypermetropic refractive errors.



## 6. Discussion

Age-related changes in the eyes affect vision. Simple refractive presbyopia can be easily managed by glasses, but age related lens changes as cataract erupts new refractive status to the patient. Epidemiologically and biologically, the relationship between types of cataract and refractive errors is not clearly understood, so our study is a trial for a better understanding to the refractive status after cataract emergence.

We included 55 patients affected by different types of cataract (very small sample size which doesn't give a real reflection on the community size), but we took a control group of 58 healthy subjects in the reproductive age just to get an inspiration about the general status of refractive errors in the community although the age is dissimilar but that can be explained as of the aging process in the cataract group, 65.5% of them had no refractive errors and myopia was the most prevalent refractive error representing 22.4% of the sample ; Myopia is the most frequent refractive error according to extensive studies such as the Blue Mountains Eye study(4) and Reykjavik Study(5), and hypermetropia was the least common in the sample representing only 1.7% and 10.3% had astigmatic errors; while, we missed to give more information about the degree of refractive errors itself and more data about the visual acuity status and correction which was a pitfall. Of the study group females with cataract were the predominant and the same in the control group and

which is also the same in studies with large community sample as Beaver Dam eye study (6), The Tehran Eye Study (7) and for Ajenjo and colleagues (8) too, and the mean age was 57.9 years (SD 6.2). For the control group the mean age was 23.2 years (SD 4.3).

The prevalence of cataract types was cortical cataract 15 patients (27.3%), 17 (30.9%) had nuclear cataract, and 23 (41.8%) had posterior subcapsular cataract those results are going with a larger study sample of The Tanjong Pagar Survey (9).

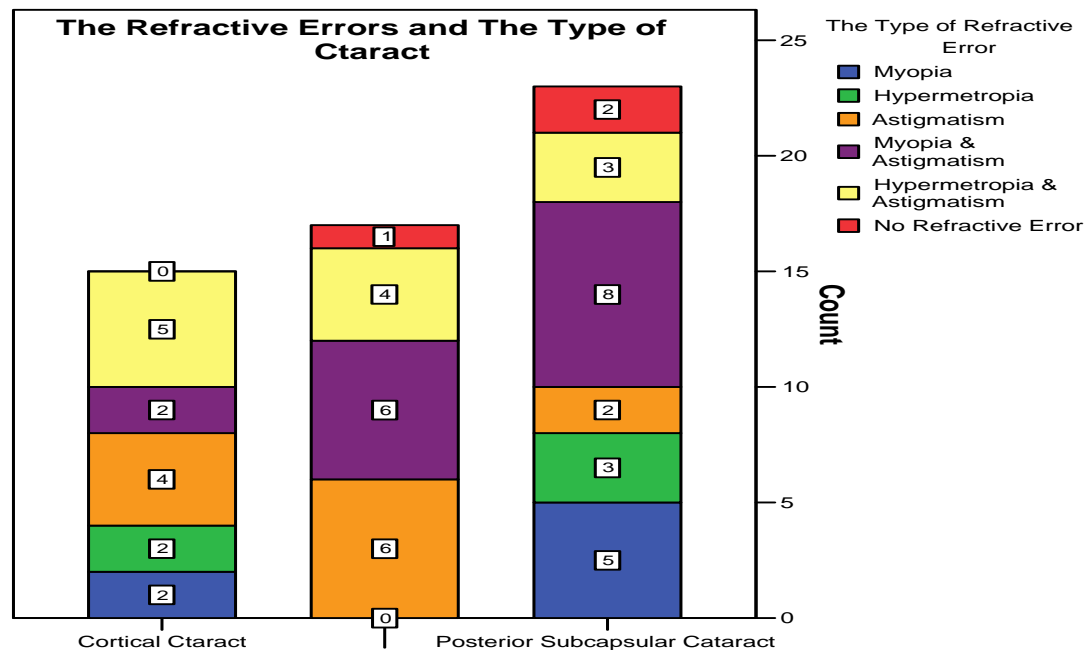
In this study nuclear cataract represented 30.07% of the total patients and was associated with astigmatic errors and myopic astigmatism mostly, the control group also showed significantly large number of myopic and astigmatic refractive errors. Unlike previous studies(6, 7, 8, 9, 10) that showed nuclear sclerosis can cause significant myopic shift, our study showed myopic astigmatism this can be explained by pre-existing hypermetropia that was neutralised by myopic shift caused by nuclear cataract, our small sample and the non pure single type of cataract. In Blue Mountains Eye Study (11), showed that increased grades of nuclear cataract, especially grades 4 and 5, are associated with -0.34 D myopic shift

For astigmatism Ajenjo and colleagues (8) noticed astigmatic power changes occur with cortical cataract, while

axis changes occurs more with posterior subcapsular cataract and less with nuclear cataract.

Posterior subcapsular cataract was associated with myopic shift and myopic astigmatism, and this can be explained by the early nuclear sclerosis. Other studies confirmed that the

prevalence of myopia was significantly higher in posterior sub capsular cataractpatients compared with those without cataract. Similar results have been reported in population-based studies such as the Beaver Dam Eye Study (6)and Blue Mountains Eye Study(12).



Our results indicated that hyperopia was significantly higher in subjects with cataract compared with control group. Additionally, no significant correlation was observed between hyperopia and different types of cataract in our study. The Tehran Eye Study (7) indicates correlation between cortical cataract and hyperopia. While Ajenjo and colleagues (8) indicated no relation between Cortical cataract appeared to cause significant astigmatic shifts. In our small sample, this occurred in about a three quarter of subjects with cortical cataract. This matches with K. Pesudovs and colleagues (10) while Tanjong Pagar Survey(9) indicated no correlation for cortical cataract with special type.

The mechanism by which cortical cataract induces astigmatismis unclear. Thecataract induced astigmatism is more likely to be caused by asymmetrical refractive index changes within parts of the cortex of the lens, creating coma-like aberration and astigmatic shifts in refractive error. The suggestion that the negative axis of astigmatism may correspond to the axis of a cortical spoke in the undilated pupil supports this hypothesis. In our small sample, cortical cataract was associated with a significant astigmatic shift. Unlike previous studies, in this study nuclear cataracts showed myopic shift but only with astigmatic changes. A more accurate figure for the prevalence of astigmatic shifts in patients with cortical cataract could be obtained with a larger sample. We suggest that the cataract induced astigmatism seen in some of the subjects with nuclear cataract is more probably the result of early cortical rather than the nuclear opacity itself.

## 7. Conclusion

About three quarters of patients with age related cataracts showed significant astigmatic refractive errors compared to 10% of the control group. Unlike previous studies, in this study nuclear cataracts showed myopic shift but only with astigmatic changes. Like previous studies, cortical cataract in this study was associated with astigmatic shift.

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