



Article original

Astigmatism induced by manual small-incision cataract surgery at the Chad-China friendship University Teaching Hospital in N'djamena (CHU-ATC)

Astigmatisme induit par la phaco-alternative au centre hospitalier universitaire de l'amitié Tchad- Chine de N'djamena (CHU-ATC)

T Ganone*¹, T Harba², GR Elien³, M Djimta⁴, M Zenaba⁵, G Koki⁵

Résumé

Introduction : le but de notre étude était d'évaluer les caractéristiques de l'astigmatisme induit par la chirurgie de cataracte par Phacoalternative au service d'ophtalmologie du Centre Hospitalier Universitaire de l'Amitié Tchad-Chine de N'Djamena.

Méthodologie : il s'agissait d'une étude transversale, descriptive et prospective réalisée de septembre 2024 à août 2025. Étaient inclus tous les patients de 40 ans et plus opérés de cataracte, suivis jusqu'à J45. Les cataractes congénitales, post-traumatiques et associées aux pathologies cornéennes astigmatogènes étaient exclues. Les variables socio-démographiques, cliniques, thérapeutiques et évolutives étaient analysées par SPSS18.0.

Résultats : au total, 280 yeux de 224 patients étaient opérés. L'âge moyen des patients était de 60,7±9,9 ans. Le sex-ratio de 1,3 était noté. Les ménagères représentaient 34,8%, au sein des patients majoritairement venus de N'Djamena (86,6%). L'acuité visuelle préopératoire était <1/10 dans 96,4%. Tous les patients étaient opérés en phacoalternative

sous anesthésie loco-régionale. La puissance moyenne de l'implant emmetropisant était de 21,4±3,3D. Les complications per-opératoires étaient dominées par la rupture capsulaire avec issue du vitre (9,8%). L'œdème cornéen (9,6%) et les cataractes secondaires (4,5%) représentaient respectivement les principales complications post-opératoires précoces et tardives. L'acuité visuelle de loin post-opératoire sans correction était ≥ 3/10 dans 77% de cas et 82% avec correction.

L'astigmatisme préopératoire pour l'ensemble des patients était de 1,3±0,97D [0 et -3.50D]. Leur moyenne en postopératoire était de 2,68±1,18D [-0.50 et -6.00D] soit un astigmatisme induit moyen de -1,38D.

Conclusion : la chirurgie de la cataracte par phacoalternative avec incision linéaire supérieure induit un astigmatisme inverse.

Mots-clés : astigmatisme, cataracte, phacoalternative, N'Djamena - Tchad.

Abstract

Introduction:The aim of our study was to evaluate the characteristics of surgically induced astigmatism following manual small-incision cataract surgery (MSICS) at the Ophthalmology Department of the Chad-China Friendship University Teaching Hospital in N'Djamena.

Methodology:This was a cross-sectional, descriptive study with prospective data collection conducted from September 2024 to August 2025. Inclusion criteria comprised all patients aged 40 and over who underwent cataract surgery and were followed up until day 45. Congenital, post-traumatic, and cataracts associated with astigmatic corneal pathologies were excluded. Socio-demographic, clinical, therapeutic, and outcome variables were analysed using SPSS 18.0.

Results:In total, 280 eyes from 224 patients were operated on. The mean age of patients was 60.7 \pm 9.9 years, with a sex ratio of 1.3. Housewives represented 34.8% of the cohort, with the majority of patients coming from N'Djamena (86.6%). Preoperative visual acuity was $<1/10$ in 96.4% of cases. All patients underwent MSICS under local anaesthesia. The mean power of the emmetropising intraocular lens was 21.4 \pm 3.3D. Intraoperative complications were dominated by posterior capsule rupture with vitreous loss (9.8%). Corneal oedema (9.6%) and secondary cataracts (4.5%) were the main early and late postoperative complications, respectively. Postoperative unaided distance visual acuity was $\geq 3/10$ in 77% of cases and 82% with correction.

Preoperative astigmatism for all patients was 1.3 \pm 0.97D [0 to -3.50D]. The postoperative mean was 2.68 \pm 1.18D [-0.50 to -6.00D], representing a mean surgically induced astigmatism of -1.38D.

Conclusion:Cataract surgery by MSICS with a superior linear incision induces against-the-rule astigmatism.

Keywords:astigmatism, cataract, MSICS, N'Djamena - Chad.

Introduction

Cataract is the leading cause of curable blindness worldwide, and surgery is the only known effective means of addressing it [1]. According to the World Health Organization (WHO) report of October 2023, 94 million people are affected by cataract worldwide [2]. It constitutes one of the main causes of visual impairment and blindness globally, particularly among the elderly. In Africa, the annual number of new cases of blinding cataract has been estimated at 300,000 [3]. South of the Sahara, it represents the primary cause of blindness with a backlog of more than 16,000 new cases per year [4]. With increasing life expectancy in developing countries, the demand for cataract surgery continues to grow, leading to a high prevalence of cataract-related blindness [5]. To address this, surgery remains the only effective means of combating cataract. Over the years, surgical techniques have gradually evolved towards less invasive methods with a concomitant reduction in complications and follow-up time, making this surgery ambulatory.

Phacoemulsification constitutes the reference technique worldwide, although its cost limits access in developing countries [6,7]. In Africa, surgical techniques have seen improvements in recent years, evolving from intracapsular extraction to extracapsular extraction, leading to manual small-incision cataract surgery [6]. Manual small-incision cataract surgery (MSICS), which emerged around the 1990s, is the most widely used technique [7]. This technique, also called Small Incision Cataract Surgery (SICS) or small-incision cataract surgery, is currently the best option for developing countries due to its financial accessibility [8,9]. It has been practised in our department for about ten years. Despite proper surgical performance and accurate biometry, some patients end up with unsatisfactory visual acuity. Refraction often reveals significant astigmatism. To improve visual comfort and postoperative dependence on optical correction, we conducted this study to evaluate the characteristics of corneal astigmatism

induced by MSICS cataract surgery and to suggest recommendations for improving the quality of this surgery.

Methodology

This was a cross-sectional, descriptive study with prospective data collection conducted from September 2024 to August 2025 at the Ophthalmology Department of CHU-ATC in N'Djamena, Chad. Inclusion criteria comprised all patients aged 40 years and over who underwent MSICS cataract surgery on an outpatient basis, who regularly attended postoperative follow-up visits until day 45, and who consented to the study. Non-consenting patients, those receiving sutures, and those who did not comply with postoperative follow-up were not included. Patients underwent a complete ophthalmological examination including measurement of distance visual acuity using Snellen and/or Monoyer charts, intraocular pressure measurement using a CT1P air-pulse tonometer (Topcon), and corneal curvature measurement using a Tonoref II keratometer (Nidek). Examination of the anterior and posterior segments after maximal pupillary dilation with 5% tropicamide completed the assessment. Patients also underwent preoperative biological testing (fasting blood glucose, prothrombin time, cephalin-kaolin time) and echography using a Vinstar device in A and B modes to eliminate any posterior segment pathology and calculate the power of the emmetropising intraocular lens. Patients were operated on under peribulbar anaesthesia consisting of an average mixture of 6cc of 0.5% Bupivacaine and 2% Xylocaine.

MSICS consisted of making a conjunctival disinsertion at the limbus superiorly of approximately 10mm centred on 12 o'clock, followed by thermocautery haemostasis. A linear scleral pre-incision of approximately 6 to 8mm in length centred on the 12 o'clock meridian, 2mm from the limbus superiorly, was performed. A tunnel was constructed using a Crescent knife up to the corneal thickness. The lateral walls of the tunnel were enlarged, followed by keratotomy

for injection of viscoelastic product into the anterior chamber. Anterior capsulotomy was performed in a can-opener fashion. Hydrodissection was followed by luxation of the lens into the anterior chamber, and then keratotomy was completed. The nucleus was then expelled entirely through the corneo-scleral tunnel after injection of viscoelastic with a double-stream crater technique. Residual masses were extracted by manual irrigation-aspiration using the double-stream Simcoe cannula. A rigid polymethylmethacrylate intraocular lens was introduced into the capsular bag pre-filled with viscoelastic. Rinsing of the viscoelastic product was performed by manual irrigation-aspiration. Reconstitution of the anterior chamber with physiological saline marked the end of intraocular activities. An antibiotic-corticosteroid ointment was applied to the operated eye, followed by a shell dressing to conclude the surgery.

Each patient received postoperative treatment with topical antibiotics and anti-inflammatories. Patients were followed up postoperatively at day 1, day 7, day 30, and day 45 to detect any complications. Keratometry was performed for each patient at day 15, day 30, and day 45 to determine the final astigmatism.

Astigmatism was defined as with-the-rule (direct) when the axis was between 90 degrees \pm 30 degrees and against-the-rule (inverse) for axes between 0 degrees-30 degrees or 150 degrees-180 degrees. To focus the analysis on the impact of the principal meridian axes, oblique astigmatisms (axes between 30 degrees-60 degrees and 120 degrees-150 degrees) were excluded from the analysis. The mean induced astigmatism was calculated by the arithmetic difference between preoperative and postoperative means. Functional outcomes were evaluated on the 45th postoperative day according to WHO directives and recommendations.

The variables studied were: age, sex, occupation, patient residence, lens power, and astigmatism values. Data were analysed using IBM-SPSS version 18.0. Chi-square was used for comparisons with $p < 0.05$ considered significant. The study was conducted in accordance with the ethical principles of the 2024 Helsinki Declaration [10].

Results

In total, 280 eyes from 224 patients were operated on out of 323 during the study period, representing a frequency of 69.34%. The mean age of patients was 60.7 +/- 9.9 years, with extremes of 43 and 88 years. The age group 61-70 years represented 34.8% (n=97) of cases. The male gender represented 58% (n=162) of the sample, with a sex ratio of 1.3. Patients were predominantly housewives (34.8%, n=97) and came from N'Djamena in 85.1% (n=238) of cases. The right eye was operated on in 56.3% (n=156) versus 43.7% (n=124) for the left eye. Decreased visual acuity represented 92% (n=258) of reasons for consultation. Distance visual acuity was less than 1/10 in 96.4% (n=270) of cases. The mean power of the emmetropising intraocular lens was 21.4 +/- 3.3D with extremes of 18 and 26D. All eyes had posterior chamber implantation corresponding to the biometry value.

Early and late postoperative complications were represented by corneal oedema (9.6%, n=27) and posterior capsule fibrosis (7.1%, n=20), respectively. At postoperative day 45, uncorrected visual acuity was greater than or equal to 3/10 in 77% (n=216) and increased to 82% (n=230) with correction.

Preoperatively, mean astigmatism power was less than -2D in 87.8% (n=246) of eyes and 61.1% (n=171) postoperatively.

The mean preoperative astigmatism was -1.30 +/- 0.97D with extremes of 0 and -3.50D. The mean

postoperative astigmatism was -2.68D +/- 1.18 with extremes of 0 and -6.00D. This represents a mean induced astigmatism in absolute value of 1.38D (Table I).

The mean preoperative astigmatism for patients with with-the-rule astigmatism was -1.19 +/- 0.58D with extremes of 0 and -3.00D; their postoperative mean was -2.06 +/- 0.90D with extremes of -1.00 and -5.75D, representing a surgically induced astigmatism in absolute value of 0.87 diopters.

The mean preoperative astigmatism for patients with against-the-rule astigmatism was -1.62 +/- 0.79D with extremes of 0 and -3.50D; their postoperative mean was -2.73 +/- 1.28D with extremes of -1.00 and -6.00D, representing a surgically induced astigmatism in absolute value of 1.11 diopters.

The mean preoperative astigmatism for all patients was -1.30 +/- 0.97 diopters with extremes of 0 and -3.50 diopters. Their postoperative mean was -2.68 +/- 1.18 diopters with extremes of -1.00 and -6.00D. This represents a mean surgically induced astigmatism in absolute value of 1.38 diopters (Table II).

MSICS cataract surgery with superior linear incision induced an against-the-rule astigmatism in absolute value of 1.38D.

Among eyes with residual astigmatism of -1.25 to -2.00 D, 34.3% (n=96) had visual acuity greater than or equal to 3/10.

Visual acuity greater than 3/10 was observed in 56.8% of eyes (n=159) whose postoperative astigmatism was less than -2.00 D (Table III).

Table I: Distribution of eyes according to preoperative and postoperative astigmatism power

Diopter	Preoperative		Postoperative	
	n	%	n	%
0.00 to -1.00	158	56.4	75	26.8
-1.25 to -2.00	88	31.4	96	34.3
-2.25 to -3.00	28	10	36	12.9
-3.25 to -4.00	7	2	32	11.4
-4.25 to -5.00	0	0	25	8.9
> -5.00	0	0	12	4.3
Undetermined	0	0	4	1.4
Total	280	100	280	100

Table II: Distribution of eyes according to preoperative and postoperative astigmatism axis

Axis	Preoperative		Postoperative	
	n	%	n	%
With-the-rule (60 to 120 deg)	137	48.9	56	20
Against-the-rule (0-30 or 150-180 deg)	107	38.2	204	72.9
Oblique (30-60 or 120-150 deg)	36	12.9	20	7.1
Total	280	100	280	100

Table III: Correlation between astigmatism power and postoperative visual acuity

Power	Visual Acuity			Total n(%)	OR	95% CI	p-value
	<1/10 n(%)	1 to 2/10 n(%)	> 3/10 n(%)				
<0.50	0	2 (0.7%)	25 (8.9%)	27 (9.6%)	1.8	[1.4-2.4]	0.017
-0.50 to -1.00	4 (1.4%)	3 (1.1%)	49 (17.5%)	56 (20%)	1.9	[1.5-2.4]	0.000
-1.25 to -2.00	5 (1.8%)	6 (2.1%)	85 (30.4%)	96 (34.3%)	2.1	[1.0-2.5]	0.000
-2.25 to -3.00	6 (2.1%)	6 (2.1%)	17 (6.1%)	29 (10.4%)	1.2	[0.7-2.1]	0.374
-3.25 to -4.00	3 (1.1%)	8 (2.9%)	18 (6.4%)	29 (10.4%)	1.2	[0.7-2.1]	0.374
-4.25 to -5.00	4 (1.4%)	5 (1.8%)	19 (6.8%)	28 (10.0%)	1.4	[0.9-2.2]	0.165
>- 5.00	6 (2.1%)	4 (1.4%)	1 (0.4%)	11 (3.9%)	2.0	[1.7-2.3]	0.121
Undetermined	1 (0.4%)	1 (0.4%)	2 (0.7%)	4 (1.4%)	2.2	[1.7-2.3]	1.000
Total	29 (10.4%)	35 (12.5%)	216 (77.1%)	280 (100%)	3.3	[2.3-4.8]	0.000

Discussion

Socio-demographic aspects

The mean age of patients was 60.7 +/- 9.9 years with extremes of 43 and 88 years. This figure is comparable to that of Nganga et al. in Brazzaville in 2017 (65 +/- 11 years) [11], Hassane et al. in Guinea in 2023 (62 +/- 12.18 years) [6], and Konan et al. in Conakry in 2023 (66 +/- 9.93 years) [12]. These figures illustrate that cataract is a disease of the elderly.

A male predominance was observed with 58%. This finding is similar to those reported by Nganga et al.

in Brazzaville in 2017 [11] and Diallo et al. in 2015 in Burkina Faso [13], who found 56% and 57.7%, respectively. Conversely, Hassane et al. reported gender equity [6], while Windigmannegde et al. in Burkina Faso [14] found a female predominance (50.38%). This diversity of results would be explained by the fact that cataract is not a sex-related pathology. Housewives were the most represented with 34.8%. This predominance was also reported by Hassane et al. [6] (39%) and Diallo et al. [13] (60%). This high frequency of women would be linked to a financial facility put in place thanks to the Chinese subsidy

that makes cataract surgery accessible to this socio-professional category with limited resources.

The majority of our patients came from N'Djamena (85.1%). This finding was similar to that of Hassane et al. [6] and Diallo et al. [13], who reported 88% and 59% of samples from urban centres, respectively. This urban predominance would be linked to the geographical position of the university hospital for city residents.

Clinical aspects

The right eye was the most operated on in 56.3% versus 43.7% for the left eye. This rate is close to that of Diallo et al. (56.7%) [13]. Conversely, Hassane et al. [6] reported 59% for the left eye. This finding seems to be due to chance.

• **Preoperative visual acuity**

Visual acuity was less than 1/10 in 96.4% of cases. These results are close to those of Hassane et al. [6] and Diallo et al. [13], who reported visual acuity less than 1/20 in 99% and 70.7%, respectively. This confirms the general trend that cataract patients in developing countries consult and undergo surgery at the stage of blindness or severe visual impairment.

• **Postoperative visual acuity**

Uncorrected postoperative visual acuity at day 45 was greater than or equal to 3/10 in 77% of cases and in 82% with correction. These data are below WHO standards and recommendations for cataract surgery outcomes [14]. This uncorrected result is lower than that of Hassane et al. [6] and Koman et al. [12], who found 82%, but higher than that of Windigmannegde et al. [15] (57%).

After correction, our result (82%) is lower than that of Koman et al. [12], who found 92%. These results would be linked to the site and shape of the scleral incision, which induces more against-the-rule astigmatism, a source of poor visual acuity, corroborating data from the literature [6,11].

• **Preoperative astigmatism**

Mean preoperative astigmatism was less than -2.00D in 87.8% of eyes with a mean of -1.3 ± 0.97D. This mean was similar to results obtained by Nganga et al. [11], who found -1.37D, higher than data from

Hassane et al. [6] and Diallo et al. [13], who reported -1 ± 1.2D and -1 ± 0.87D, respectively, and lower than that of Hazra et al. in India in 2021 with 0.8D [16]. Astigmatism was with-the-rule in 48.9% of cases and 38.2% against-the-rule. These data were also found by Hassane et al. [6], namely 57% with-the-rule preoperative astigmatism and 31% against-the-rule. Conversely, Nganga et al. [11] reported a predominance of against-the-rule astigmatism of 78%, corroborating literature data according to which against-the-rule astigmatism is more frequent in elderly subjects [16]. These divergent results would be linked to methodology.

• **Postoperative astigmatism**

Postoperatively, the number of eyes with with-the-rule astigmatism decreased from 78.2% preoperatively to 38.2% postoperatively, representing a regression of 28.9% of cases. This finding was also reported by Hassane et al. [6], Nganga et al. [11], and Konan et al. [12]. This observation would be explained by the flattening of the vertical axis related to the superior linear incision, which slightly bulges the horizontal meridian, creating astigmatism requiring stronger correction in the horizontal axis.

The number of against-the-rule astigmatism existing preoperatively increased postoperatively, rising from 38.2% to 72.9%, representing a progression of 31.1%. This situation was aggravated by surgery, as it induces against-the-rule astigmatism. This observation was also reported by Konan et al. [12] and Hazra et al. [16], confirming the astigmatogenic nature of the superior scleral incision. Our results show that the superior approach induces significantly higher astigmatism (1.38D) than the temporal approach, as reported by Makayee et al. (0.57 ± 0.4D) [17] and Tripathi et al. (1.09 ± 0.42D) [18]. This difference would be explained by the fact that the temporal incision is located further from the visual axis than the superior incision, which minimises central corneal flattening. Functionally, visual acuity was greater than or equal to 3/10 in 56.8% (n=159) of eyes with postoperative astigmatism of less than 2.00D. A significant correlation was observed between astigmatism power

and visual acuity ($p < 0.001$), with acuity decreasing as astigmatism increases (negative association), with a peak from $-2.25D$. This finding is in agreement with results reported by Hazra et al. [16].

The mean postoperative astigmatism was $-2.68D \pm 1.18$ and $-1.30 \pm 0.97D$ preoperatively, for a mean induced astigmatism of $-1.38D$. This result is close to that of Diallo et al. [13] ($1.30D$) but higher than Nganga et al. [11] ($-1.24D$) and lower than that of Hassane et al. [6] ($3.15D$).

The axis of postoperative astigmatism was predominantly against-the-rule in 72.9% of cases. MSICS cataract surgery in our study induced a mean against-the-rule astigmatism in absolute value of $1.38D$.

Although the superior incision provides ergonomic comfort for the surgeon, it generates higher induced astigmatism, justifying the temporal incision approach, which is less astigmatogenic. This approach requires a change of position and readaptation by the surgeon, which in a context of intense surgical activity could slow down the volume of activity in the operating theatre. Therefore, the choice of incision could be made according to preoperative astigmatism, favouring the temporal approach for the majority of elderly patients and complex cases.

Conclusion

This study enabled us to determine the characteristics of astigmatism induced by MSICS cataract surgery in our setting. It confirms that MSICS with superior incision induces against-the-rule astigmatism. It would therefore be necessary to consider a change in incision site and/or shape to reduce the dioptric power of against-the-rule astigmatism, which is a source of visual discomfort for our patients if we wish to improve their quality of life in old age.

Author Contributions

All authors contributed to, read, and approved the final version of the manuscript.

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*Correspondance

GANONE Tedang

tedangganone@gmail.com

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- 1 : Ophthalmology Department, CHU-ATC, N'Djamena, Chad
- 2 : Ophthalmology Department, CHU Abeche, Chad
- 3 : National University Hospital Center, Bangui, Central African Republic
- 4 : Ophthalmology Department, CHUR N'Djamena, Chad
- 5 : Ophthalmology Department, Mother and Child University Hospital, N'Djamena, Chad
- 6 : Faculty of Medicine and Biomedical Sciences, University of Yaounde I, Cameroon

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References

- [1] Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti SP. Donnees mondiales sur la deficiance visuelle en 2002. *Bull Org Mond San*. 2004 ;82(11) :844-851.
- [2] Blindness and Vision Impairment Collaborators: Vision Loss Expert Group of the Global Burden of Disease Study. Causes of blindness and vision impairment in 2020 and trends over 30 years and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *Lancet Glob*

- Health. 2021 ;9(2):144-160. doi: 10.1016/S2214-109X(20)30489-7
- [3] The International Agency for the Prevention of Blindness (IAPB). 2030 In Sight, 2021, 68p. Disponible sur: <https://www.iapb.org/about/2030-in-sight/>
- [4] Sovogui MD, Lama PL, Bah TM, Baide R, Zoumanigui C, Balde AK, Vonor K. Chirurgie de la cataracte par phacoalternative a la clinique Bartimee a Conakry (Guinee). *Mal Med* 2022, 38;(2):1-5.
- [5] OMS (2006) Initiative pour l'elimination de la cecite evitable, plan d'action 2006-11. Rapport d'un groupe de travail de travail de l'OMS Geneve, 2002(OMS.PBH.03.92) <http://docplayer.fr/fr>.
- [6] Hassane ABT, T Agli, MR N'diaye, I Fofana, A Saley, MO Bah, MO Barry, O Tonouehoua, AM Ketema. Astigmatisme Induit apres Phaco-Alternative: A Propos de 100 Yeux Operes au CHU Donka, Conakry. *Health Res Afr* 2024,2;(8):56-60 Available free at <http://hsd-fmsb.org/index.php/hra>
- [7] Nadio T, Napo A, Balde R, Sidibe MK, Conare I, Traore L, Bamani S, Traore J. Extraction extra capsulaire versus phaco manuelle sans sutures dans le traitement de la cataracte de l'adulte au CHU-IOTA. *Mal Med*. 2017; 32 (3):16-19.
- [8] Maneh N, Ayena DK, Nagbe YE, Amouzou MD, Barry WM, Akakpo AW, Diatewa MB, Awoussi S, Adom WK, Balo KP. Chirurgie gratuite de la cataracte en strategie avancee a Lome (Togo): quel gain visuel. *J Rech Sci Univ Lome* 2017; 19 (1):425-31.
- [9] Ngabou CGFN, Makita C, Ambia RKM, Diatewa B, Nkokolo F. Strategie et chirurgie de la cataracte par petite incision : premiere exterieur a Oyo, Republique du Congo. *Ann Afr Med*.2018 ;12(1):e3122-e3127
- [10] Wise J. Helsinki declaration: Rights of study participants are put at heart of latest update. *BMJ* 2024; 387: q2357. Doi:<https://doi.org/10.1136/bmj.q2357>.
- [11] Ngabou CGFN, Makita C, Ambia RKM, Diatewa B, Nkokolo F. Astigmatisme induit par la chirurgie manuelle de la cataracte par petite incision corneenne en superieur. *Ann Universite Marien Nguouabi*.2017 ;17(1):67-74.
- [12] Koman CE, Agli T, N'da HC, N'diaye MR, Fofana I, Saley A et al. Study of Induced Astigmatism After Cataract Surgery by Phacoalternative. *Euro J Prev Med* 2023; 11(1): 6-10. Available free at <http://www.sciencepublishinggroup.com/j/ejpm> doi: 10.11648/j.ejpm.20231101.12
- [13] Diallo JW, Meda N, Ahnoux-Zabsonre A, Yameogo C, Dolo M, Sanou J, et al. Resultats fonctionnels de la chirurgie de la cataracte par phacoalternativeavec implantation en chambre posterieure: a propos de 300 cas a Bobo Dioulasso (Burkina Faso). *Pan Afr Med J*. 2015;20(1):230. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4482526/>
- [14] Koffi KF-H, Goule AM, Diabate Z, Bile PEFK, Diomande GF, Gode L, Babayeju RLO, Koffi KAP, Ouattara Y, Diomande IA. Aspects Epidemiologiques et Etiologiques des Cecites Irreversibles a Bouake. *Health Sci Dis* 2025,26;(1):85-89. Available free at www.hsd-fmsb.org
- [15] Windinmanegde P, Diomande I, Ahnoux-Zabsonre A, Koffi K, Meda T, Diomande G, Sanou J, Meda-Hien G, Sankara P, Meda N. Resultats de la chirurgie avancee de la cataracte par tunnelisation : a propos de 262 cas realises au CHR de Banfora. *Pan Afr Med J* 2015; 22 :366. doi:10.11604/pamj.2015.22.366.8416 This article is available online at: <http://www.panafrican-med-journal.com/content/article/22/366/full/>
- [16] Hazra S and Saha TK. A comparative study of post-operative astigmatism in superior versus superotemporal scleral incisions in manual small incision cataract surgery in a tertiary care hospital. *Int J Clin Exp Ophthalmol*. 2021; 5:9-15. DOI: 10.29328/journal.ijceo.1001036
- [17] Abdul Aziz Makayee, Nilofar Nazir, Maroof Nabi, Saliya Ayoob. A Prospective Comparative Study of Astigmatism Following Manual Small

Incision Cataract Surgery: Superior Verses. OSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 18, Issue 1 Ser. 16 (January. 2019), PP 01-04. www.iosrjournals.org

[18] Tripathi, Abhishek Kumar; Joshi, Ajit Kamalakar; Mandlik, Hanumant. Etude comparative de l'astigmatisme induit chirurgicalement dans les incisions sclerales superieures et temporelles chez les patients en chirurgie manuelle de la cataracte de petite incision. Journal medical du Dr. D.Y. Patil Vidyapeeth [15(5):p 674-681, sept.-oct. 2022.] DOI: 10.4103/mjdrdypu.mjdrdypu_658_21

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