Research Article

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Therapeutic Virtues of Mollusk Shell Extracts in Non-Trachomatous Corneal Opacities in the DRC (Case of Bivalves and Gasteropods in the Urban-Ural Population of Lubumbashi and Its Surroundings)

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ABSTRACT

Aim: *To propose a therapeutic alternative to corneal transplantation, treatment with bivalve and gastropod mollusc shells inspired by the practice of traditional practitioners commonly used in the resorption of non-trachomatous corneal opacities in Lubumbashi and its surroundings.*

Methods: *Retrospective data collection case-control analytical study, carried out in two urban-rural centers for the treatment of non-trachomatous corneal opacities from 2011 to 2016. The University Clinics of Lubumbashi served as patient follow-up and constituted the control group of patients treated with conventional medications and five traditional practitioner structures comprised the experimental group of patients treated with shells. The size (surface and depth) of the corneal opacity was assessed by slit lamp.*

Results: *Out of 1244 patients with corneal lesions, 281 patients had corneal opacity (22.59%). The control group: 183 (65.12%) and the experimental group: 98 (34.88%). The mean age: 25.2±15.9 years. Male gender (57.3%), left eye (52.7%), visual acuity ≥ 3/10 (38.1%), unilateral opacity (85.94%) and bilateral opacity (14.06%), blindness (53.38%). The causes: infectious and traumatic corneal ulcer (97.15%), infectious keratitis (73.66%), trauma (36.3%), LCET IV (28.11%), operated pterygium (22.06%), operated tumor (10.68%) and others (8.91%). Superficial opacities (60.14%), leukoma (39.86%).*

At the second month of treatment, remarkable regression of the size of the corneal opacity (p=0.000). From 6 to 12 months, 95.92% had good progress with the shells (OR=4.281; CI: [3.259-5.623]) with complete healing of the corneal opacity in 99 patients (82.65% shells, 9.84% with conventional medical treatment).

Conclusion: *Article 58 to 60 of our legislation recognizes traditional medicine by its properties for human diseases, treatment with mollusks has a link to the resorption of corneal opacities but conventional medical treatment remains limiting in our care environment.*

Keywords
Therapeutic virtues, Molluscs, Traditional practitioners, Corneal opacities.

Introduction
Corneal opacity is a disorder of corneal transparency that can occur following a degenerative process or infection as well as trauma or burns. Corneal opacity represents 3.46% of global blindness, 1.65% of global blindness and visual impairment [1]. It is the leading cause of blindness in children [2]. In developing countries, corneal blindness affects all age groups, approximately 80% of cases are preventable [3]. The causes of corneal blindness come in 5th position after cataracts (51%), glaucoma (8%), AMD (5%), childhood blindness (4%) [4]. Two studies conducted in Kinshasa showed that 4.9% was represented by corneal leukoma [5] and 5% corneal opacities and [6].

In general, corneal transplantation remains a reference treatment for corneal opacity, but remains imperfect due to several complications it causes such as graft rejection. This practice is not common in the Democratic Republic of Congo (DRC) because our legislation prohibits in Article 66 the use of tissues and organs of a person who died by accident or illness without prior written consent from their beneficiaries and 68 the trafficking of organs and tissues [7]. Given that all patients with corneal opacities are transferred to specialized entities abroad for corneal transplantation, this poses a problem of care for patients with corneal opacities especially for needy families because the majority of these patients being financially limited are not able to go there and remain blind in our environments. It turns out that treatment with bivalve and gastropod mollusk shells has a link to the resorption of corneal opacities. The aim of this study is to propose a therapeutic alternative to corneal transplantation, treatment with the shells of bivalve and gastropod molluscs that we were inspired by the current practice of traditional practitioners used in the resorption of non-trachomatous corneal opacities in Lubumbashi and its surroundings , given that the legislation in the DRC in its articles 57 and 58 recognizes the practice of traditional medicine to work for its preventive and curative properties with regard to human diseases [7].

Methodology
This study is a case-control analytical study with retrospective data collection, carried out at the ophthalmology reference center of the Lubumbashi university clinics which served as a center for diagnosis, monitoring and evaluation of all patients with corneal opacities from the city of Lubumbashi and its surroundings in the Haut-Katanga province, over a period of 5 years from 2011 to 2016. The data were collected from the records available at the ophthalmology department of the Lubumbashi University Clinics and from those recorded from the selected and examined patients from the five structures in collaboration with traditional practitioners. Thirty-one million and thirty-eight thousand records were listed at the ophthalmology department of the Lubumbashi university clinics during the study period. Of this total recorded subjects examined, 1244 patients had a corneal lesion, had corneal opacity in 281 patients selected according to a convenience sample. Two study groups were identified, comparing two types of treatment. They were divided into a control group for the urban setting, including the ophthalmology department of the University Clinics of Lubumbashi, consisting of 183 patients who had been treated with available conventional medications. The second group was considered experimental from the rural environment comprising 98 patients from the five structures of corneal opacities therapy in collaboration with traditional practitioners and having benefited from the latter the treatment based on extracts of shells of bivalve molluscs and gastropods, it is the structure of Hewa bora in the commune of Kampemba which is located 4 km from the university clinics of Lubumbashi, Dilanda towards Kafubu at approximately 14.3 km, Kasumbalesa at 94.4 km, Mokambo at 175 km, Sakania at a distance of 224 km and Kilwa is 2264 km from the university clinics of Lubumbashi [8].

We included in the study according to a pre-established criterion all patients with corneal opacity and the variables of interest retained were: the origin of the patients, age, sex, visual acuity, the affected eye, the causes and types of corneal opacities as well as the affected corneal layers, the types of treatment received by the patients (conventional medical treatment and treatment with bivalve and gastropod mollusc shells, the time to treatment and the evolution of the patients in 3 phases of treatment (≤ 1 month: 1st phase; 2nd month: 2nd phase; 6 months to one year of treatment: 3rd phase). Patients with trachoma, corneal dystrophy and all those who did not meet the pre-established criteria were excluded from the study.

On examination, each patient underwent a routine ophthalmological examination. We each time proceeded to the diagnosis of corneal opacity by noting the etiology (infectious, traumatic), changes in corneal transparency (edema, scars, new vessels), and corneal thickness (thickening, thinning, descemetocele, change in curvature), hypertonia, corneal sensitivity, the Seidel test, the use or not of corticosteroid therapy and the affected corneal layer (epithelial or subepithelial).

The size of the corneal opacity (surface and depth) was measured at the slit lamp by looking for the edges (regular, irregular, short), the topography of the corneal opacity in relation to the visual axis (central: which occupies the entire pupil, paracentral: which spares the pupillary area, peripheral: which occupies the anterior surface of the limbus).

The size of the corneal opacity was assessed according to the corneal haze classification method by Fantes et al. [9] who assessed it on a scale of 0 to 4; 0 for no haze, 0.5 for moderate haze making refraction difficult but still possible (corneal opacity) ; 3 for corneal opacity that partially obscures iris details and prevents refraction (nephelion); and 4 for severe opacity completely obscuring intraocular structures (leukoma).

Treatments for patients with corneal opacity have been described

(conventional medical and mollusc shell extracts):

-Conventional medical treatment was administered in the form of eye drops, tablets, or ointments, which could or could not be combined with a dressing or surgery depending on the therapeutic indication. This treatment included eye healing agents (vitamin B12), vitamin A, corticosteroid therapy, and dressings, which could be combined with antibiotic, antiviral, anti-inflammatory, or antiseptic ointments or eye drops; the use of eye ointments was specific for galvanic applications. Corticosteroid therapy consisted of dexamethasone (one 5 to 10 ml bottle dosed at 0.1%, with or without neomycin at 0.35%). Vitamin A therapy used was one 10 ml bottle dosed at 1000 to 15,000 IU at a rate of one drop 3 to 6 times a day or in ointment, one tube of 25,000 IU per 100 g or retinol soft capsule dosed at 50,000 IU at a rate of one capsule per day according to the patient's needs, not exceeding 30 days of treatment, and vitamin B12, one bottle, dosed at 0.05% (0.2 mg/0.4 ml) at a rate of 3 to 4 times a day depending on the ocular disorders and the damaged corneal layer.

The treatment with shells of bivalve molluscs and gastropods commonly used by traditional practitioners to treat corneal opacities was administered for bivalve molluscs the genus clam venerupis, family abra-profundorum, gari Sp and for gastropods the genus alamy cyppraca tigris, family cystiscidae, persiculapersicula. The interview with the traditional practitioner(s) was done by interview. He specified what was the source of supply of the molluscs used (Lake Moero 336 km from Lubumbashi and Lake Tanganyika located 643 km) [10,11], the procedure for extracting powder extracts from mollusc shells, the duration, rhythm and follow-up on the administration of the treatment.

Once the shells were collected, they were washed and exposed to the sun before use during the day, if not used, they were kept in sterile boxes soaked in an antiseptic. The treatment was administered in the form of powder extracts of the shells of the mollusks previously pounded or scraped the inside or outside of the shell with a scalpel or a new razor according to the indication of the corneal pathology. The shell powder obtained was measured on a teaspoon divided into 3 of which 1 / 3 of the content corresponded to approximately 3g of powder which was mixed with distilled water (3 to ≥ 5cc) used as a solvent to be put in bottles sterilized beforehand by means of an autoclave. Once the mixture is ready, the traditional practitioner administered it in the eye of his patient 2 to 3 times a day depending on the severity of the corneal opacity. Treatment with mollusc shell powder extracts was used for 2 to 4 weeks for patients with epithelial opacity or 4 to ≥ 24 weeks for extensive or deeper subepithelial corneal opacities. Follow-up of all patients was less than one month to one year depending on the severity of corneal opacity or affected corneal layer.

Results

Sociodemographic and Clinical Characteristics of Patients

Out of 31,038 subjects examined, 1244 patients had corneal involvement, i.e. 4% of all consultations for 281 patients retained for corneal opacity with 22.59% of cases of which the control group from the urban environment had 183 patients and represented 65.12% and the experimental group from the rural environment had 98 patients with 34.88%.

Table 1: Distribution of patients according to their socio-demographic and clinical characteristics followed at the university clinics of Lubumbashi in the two study groups.

Features	Frequency (N=281)	%
Age groups	Average age: 25.2±15.9 years	
	Age range from 1 to 70 years	
≤ 10 years	53	18.86
11 to 20 years old	68	24.20
21 to 30 years old	73	25.98
31 to 40 years old	33	11.74
41 to 50 years old	30	10.68
> 50 years old	24	8.54
Sex	Sex ratio: M/F 1.3.	
Female	120	42.70
Male	161	57.30
Affected eye		
Right eye	133	47.33
Left eye	148	52.67
Visual acuity before PEC		
≥ 3/10	107	38.08
≤ 1/10 (MM, CD)	71	25.27
PL	48	17.08
Nihil	31	11.03
Undetermined	24	8.54
Causes of corneal opacity		
Infectious ulcer (bacterial, fungal, viral)	273	97.15
Infectious keratitis (bacterial, viral)	207	73.67
Trauma (CE met, insect, punch, stick	102	36.30
LCET stage 4	79	28.11
Pterygium operated	62	22.06
Corticosteroids	40	14.24
Tumor operated on	30	10.68
Other associated causes	25	8.91
Corneal opacities types and classification according to Fantes et al.		
Leukoma (4=total)	112	39.86
Nephelion (3=partial)	58	20.64
Pillowcase (2=0.5 moderate)	36	12.81
Affected layers		
Superficial opacities	169	60.14
Subepithelial opacities (leukoma)	112	39.86
Corneal opacity and affected eye (N=562 eyes)		
One-sided opacity	481	85.94
Bilateral opacity	36	14.06
Monophthalmus	12	2.14

This table shows that out of 562 eyes examined, corneal opacity was unilateral in 85.94% of the patients, the average age of 25.2±15.9 years with extreme ages from 1 to 70 years in the 2 study groups. The age group of 21 to 30 was the majority with 25.98% of cases. Male gender was dominant in 57.30%. In more than half of cases, the left eye was more affected with a rate of 52.67% than the right eye and vision was preserved in 38.08%. Blindness was observed in 53.38% (150/281). Infectious corneal

ulcers (bacterial, fungal and viral: 97.15%) are the primary cause of corneal opacity followed by infectious keratitis (bacterial and viral). Compared to the types of opacities, superficial opacities are represented in the majority of cases (60.14%) than sub-epithelial opacities which have more affected vision in 39.86% of cases.

NB: Other causes associated with corneal opacity represented a negligible rate with 8.91%: limbal thickening (3.21%), chemical burn of the cornea (2.14%) of cases, history of measles (1.26%), ophthalmic zoster (1.14%), use of medicinal plants (1.06%), dry eye due to facial paralysis with lagophthalmos (0.08%), and use of chloramphenicol in utero (0.02%). More than half of the patients had 60.14% of superficial or epithelial corneal opacities and leukoma is the subepithelial corneal opacity represented in 39.86% of cases.

Table 2: Distribution of patients according to treatment received in urban-rural areas.

Settings	Medical treatment conv, MU (N=183)	Shell treatment, MR (N=98)	p-value
Mean age ± standard deviation	26.4 ±15.9	23.1 ±15.9	0.099
Sex (%)	**SR M/F: 1.3**	**1.5**	
Female	81 (44.3)	39 (39.8)	0.471
Male	102 (55.7)	59 (60.2)	
Eye affected (%)			
Right eye	79 (43.2)	54 (55.1)	0.056
Left eye	104 (56.8)	44 (44.9)	
Visual acuity (%)			
AV ≥ 3/10°	79 (43.2)	28 (37.8)	
B AV ≤ 1/10 (MM, CD)	49 (26.8)	22 (29.7)	0.000
PL	35 (19.1)	13 (17.6)	
Nihil	20 (10.9)	11 (14.9)	
Causes of corneal opacity (%)			
Infectious ulcer	181 (98.91)	92 (93.87)	
Infectious keratitis	129 (70.49)	78 (79.59)	
Trauma	75 (40.98)	27 (27.55)	
LCET stage 4	36 (19.67)	43 (43.88)	
Pterygium operated	59 (32.24)	3 (3.06)	0.000
Corticosteroids	36 (19.67)	14 (14.29)	
Tumor operated on	28 (15.30)	2 (2.04)	
Other causes	19 (10.38)	6 (6.12)	
Types of corneal opacities			
Leukoma	57 (31.14)	55 (56.12)	0.000
Nephelion	32 (17.49)	26 (26.53)	
Pillowcase	23 (12.57)	13 (13.27)	
Layers affected (%)			
Subepithelial opacities	57 (31.14)	55 (56.12)	0.000
Superficial opacities	126 (68.85)	43 (43.88)	
Opacities and Affected Eye (N=562 eyes) (%)			
One-sided opacity	395 (70.28)	86 (15.30)	
Bilateral opacity	10 (1.78)	26 (4.63)	
Monophthalmus	5 (0.89)	7 (1.25)	

This table states that many demographic and clinical parameters were majority in the urban area than in the rural area except in some particular we noticed that the patients were monophthalmic in 1.25% and also some elements related to sex, age, affected eye were noted. Note that the association was not significant in the average age, sex and affected eye ($p>0.05$). In the rural area the male sex was dominant (sex ratio M/F is 1.5), the right eye is more affected than the left eye, the LCET st 4 and leukoma were more remarkable and the corneal opacity was bilateral than unilateral in 4.63% of cases.

Comparative Value on the types of Treatments Received by Patients in Urban-Rural Areas

Table 3: Distribution of treatment types among patients followed in the ophthalmology department of the Lubumbashi university clinics during the study period.

Types of treatments received	Effective	Percentage
Urban environment Conventional medical treatment (N=183)		
Corticosteroids (dexa or + neomycin)	130	71, 04
Dressing +/- ATB, ATV, ATF, ATS	19	10.38
VIT A eye drops or ointment	13	7.10
VIT B12 eye drops	21	11.48
Rural environment Shell treatment (N=98)		
Bivalve	86	87.76
Gastropod	12	12.22

Corticosteroid therapy is the leader among conventional medical drugs with 71.04% followed by vitamin B12 therapy in urban areas and bivalve shell treatment was more used in rural areas with a rate of 87.76% compared to gastropod shells.

Comparative Evolution of Treatments Received by Patients and Effectiveness of Treatment with Extracts of Mollusc Shells

Table 4 shows that during the study period, in the first month of treatment, there was no significant difference between the type of treatment and the evolution of the patients ($p = 0.341$). The regression of the size of corneal opacity starting from the classification of Fantes et al. [9] and according to the different phases of treatment in the two study groups was remarkable that in the second month of treatment in 64 patients or 65.31% ($p < 0.000$) with a good evolution considerably 4 times more in the patients treated with extracts of mollusc shells of the experimental group (OR = 4.281; CI: [3.259-5.623]). The number of patients with moderate corneal opacity size (skin) increased from 36 (23 for conventional medical treatment and 13 for mollusc shell treatment) in the first month to 91 (27 patients or 14.75% for conventional medical treatment and 64 patients or 65.31% for shell treatment) in the second month there was a gain of 55 patients (among whom 4 patients or 2.19% had benefited from conventional medical treatment and 51 patients or 52% from mollusc shell treatment). Between 6 and 12 months of treatment (3rd phase), the association was highly significant ($p = 0.000$) between the type of treatment and the regression of corneal opacity size. The number of patients with moderate corneal opacity increased from 36 to 135 patients in the first month (including 41 patients or 22.40% for conventional medical treatment and 94 patients or 95.92% for shell treatment). Between 6 and 12 months, a gain of healed eyes in 99 patients (81 patients with 82.65% treated with mollusc shell extracts and 18

Table 4: Distribution of patients according to the efficacy of two treatments compared in the regression of the size of corneal opacity starting from the evaluation phases observed in the urban-rural population.

Corneal opacity size / Classification of Fantes et al.	Healed		Uncured		Gain		P
	Shell (N=98)	Medical (N=183)	Shell (N=98)	Medical (N=183)	Shell (N=98)	Medical (N=183)	
1st month							
2=moderate (Tie)	13 (13.27)	23 (12.57)	0	0	0	0	0.341
3=partial (Nephelion)	0	0	28 (28.57)	68 (37.16)			
4=total (Leukoma)	0	0	57 (58.16)	92 (50.27)			
2nd month							
2=moderate (Tie)	64 (65.31)	27 (14.75)	0	0	51 (52.04)	4 (2.19)	0.000
3=partial (Nephelion)	0	0	5 (5.10)	66 (36.07)			
4=total (Leukoma)	0	0	29 (29.59)	90 (49.18)			
6 to 12 months					81 (82.65)	18 (9.84)	0.000
2=moderate (Tie)	94 (95.92)	41 (22.40)	0	0			
3=partial (Nephelion)	0	0	0	55 (30.05)			
4=total (Leukoma)	0	0	4 (4.08)	87 (47.54)			

patients or 9.84% who had benefited from conventional medical treatment).

Discussion

Frequency of Corneal Opacities and Sociodemographic and Clinical Characteristics of Patients

Corneal opacities constitute a public health problem in the city of Lubumbashi and its surroundings given its high frequency (22.59%). The relative frequency of unilateral corneal opacity was 85.94% and that of bilateral corneal opacity represented 14.06% distributed in the two groups of studies, this proportion is close to that found in Burkina Faso by Traoré et al. (14.19%) [12]. In Africa, studies have proven that corneal opacities are one of the main causes of blindness we cite: Chirambo and Tizazu in 1983 [13]; Kayembe in 1985 [5]; Cook et al., [14]; Kaimbo D. in 1997 [6]; Bowman et al., 2002 [15]. Our series showed that more than half of the patients (53.38%) had blindness due to corneal opacity. Radhika T, et al. [16] add that 95% of patients received in a hospital in India had bilateral blindness due to corneal opacity, but Anas et al. [17] in Morocco this bilateral blindness is 62% of cases and represents about 10% in children.

In our study, male gender is dominant in the study groups 55.7% for the control group and 60.2% for the experimental group with a sex ratio M/F of 1.3 in the control group and 1.5 in the experimental group and the mean age of the patients was 25.2±15.9 in both study groups, 65.1% of patients came from urban areas and 34.9% of patients are from rural areas. According to Gain et al., in 2015 [3], corneal blindness affects all age groups in developing countries. Given that approximately 80% of blindness cases are preventable, it is essential that ophthalmology maximizes the chances of visual recovery of patients and Robaei and Watson in 2014 [18], add that bilateral blindness remains an underestimated cause of visual impairment with a paucity of data to improve equitable access to services. Our results corroborate with those reported by Anas et al. [17] but inversely with respect to the origin of the patients, i.e. 64% of the origin was rural and 36% of the origin was urban, but they found a female predominance in 58% of the cases and the average age of the patients was 36 years (7-83).

Among the causes implicated in the occurrence of corneal opacity, Whitcher et al. [19] showed that trauma and ulcerations were the important causes of corneal blindness, often under-reported but which may be the cause of 1.5-2.0 million new cases of unilateral blindness each year. According to Courtright P and Lewallen S [1], trauma and suppurative keratitis are common causes of corneal opacity and may be underestimated. Corneal infections, inflammatory diseases and trauma can be treated or avoided to minimize the occurrence of corneal opacities and prevent blindness. Anas, et al. [17] state in Morocco that 22% were due to the sequelae of infectious keratitis. Our results are consistent with those of previous authors in the sense that infectious ulcers (97.15%), infectious keratitis (73.66%) and trauma (36.3%). Ukety TO [20] in 1991 in his study reported that 2 cases of corneal ulcer associated with ulcero-erosive blepharitis and 6 patients who had a dendritic ulcer on the other hand Ngoie Maloba V, et al. [21], stated in 2018 on 380 patients with ulcer a frequency of 0.85% of cases, these authors add that the average age of the patients was 38.67 years, patients aged over 40 years were in the majority with 19.2%, children aged 0-5 years represented 8.5% and those aged 6-10 years had 10.3%. Our series reported a predominance in the age group of 21 to 30 years with 26% of cases and those under 10 years had 18.9% and the average age of the patients was 26.4 years in the urban area and 23.1 years in the rural area, there was no significant difference in the average age, sex and the affected eye ($p>0.05$) in both study groups. For Ezegwui [22] the cause of ulcers apart from trauma was indigenous treatment in 19.5%. The same author further adds that 71.4% presented a visual acuity of the affected eye of 3/60 and 4 eyes or 6.2% had deteriorated visual acuity and our study showed that the left eye in the control group was more affected with 56.8% ($p=0.000$) and the right eye had a number of 55.1% in the experimental group and deteriorated visual acuity 42.35% in both study groups. Among the other causes associated with corneal opacity, the use of medicinal plants represented 1.06%, the proportion found by Ezegwui [22] is much higher. The observation made during the period of our study, of all the above can be explained by the fact that in urban areas the conditions of care are more and more supported and traditional or

indigenous treatment is discouraged for patients by the healthcare staff, while in rural areas patients are poorly informed, self-medication, financial limit and inaccessibility to quality care is not there and given that the great distances of accessibility to care between urban and rural areas expose patients to reaching deplorable states of their eye health.

Concerning LCET, the study of Chenge, et al. [23] in 2003 showed that out of 422 children examined, 139 children had LCET and according to the stages of evolution, LCET stage IV was represented in only 1% of cases, however our series shows a very high rate of this disease (43.88%) observed more in rural areas than in urban areas, this could be explained by the fact that the management of this disease had improved in the urban environment after their study. The observation made during the study period is that in the rural environment LCET seems to be poorly perceived and that its management remains less managed by the health personnel in the community. There is a large difference in proportion due to the fact that a disease can evolve in time and space by the change of many demographic and clinical parameters.

The most severe sequelae include limbic insufficiency syndrome, which includes extensive limbic ischemia affecting between one-third and one-half of the circumference following anterior segment surgery (pterygium, cataracts, and others) [24]. Sridhar, et al. [25] also reported 3 cases of ICSL in patients who underwent repeat ocular surface surgeries for the following pathologies: recurrent pterygium, perforated ulcer, and grafted keratomycosis. The main complication of pterygium surgery is the significant risk of recurrence during the first postoperative year, since 97% of pterygium that recur do so during this period, and in industrialized countries, they mainly affect young males in 66.7 to 86% [26]. Our series showed that: pterygium excision (22.06%), epibulbar tumor (10.68%), and more than half of the patients, i.e. 60.1% (169/281) had superficial (epithelial) corneal opacities. Other causes associated with corneal opacity (8.91%), including limbal thickening, had a number of 4.27% and burns represented 2.14%.

Efficacy According to Corneal Opacity Treatments and Patient Outcomes

In most low- and middle-income cases, the most common acute and blinding corneal condition requiring intervention is microbial keratitis, which requires prophylactic antibiotic treatment as soon as possible after ocular trauma to prevent the development of infection [27]. Jihad S et al. reported that for severe corneal ulcers, the treatment performed in their study was based on broad-spectrum antibiotics or on local and systemic antibiogram associated with symptomatic treatment [28], our study supports the previous authors. In severe situations, when the cornea is damaged, only the transplantation of a healthy cornea can alleviate the problem although there may be cases of rejection. Prevention and treatment depend on access to services, resources and qualified personnel [29]. Many patients may also require laser treatment apart from corneal transplantation. Our study showed that corneal opacification can be remedied with conventional medications in the form of drops or ointments with or without dressings. Treatment plans depend on the specific cause, severity and stage of the disease but bivalve and gastropod mollusc shell extracts have been shown to be effective in resorption of corneal opacities with remarkable complete cure of corneal opacity in 82.65% within one year of treatment.

Conclusion

The treatment based on extracts of shell powder from bivalve and gastropod molluscs has a link to the resorption of corneal opacities and would be another therapeutic alternative for corneal opacities in the future and could offer better results within more or less a year in the duration of treatment of these corneal opacities because it is less expensive and beneficial for our population. No one is unaware of the benefits that nature offers to treat various diseases as recognized by our legislation in the DRC in its articles 58 to 60. The mollusk and its shell always retain a part of mystery, this perhaps conceals other useful properties for future medicine, and even if this were not the case, recent discoveries about this small animal prove at least that it was not useless to be interested in it.

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Appendix

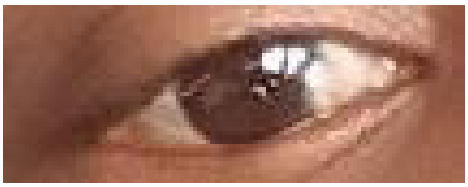

Figure 1: Stage II pterygium on the 1st day.

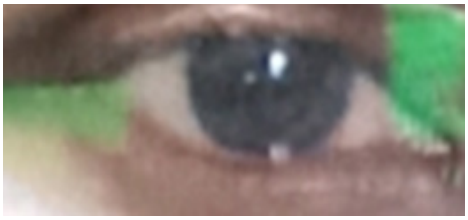

Figure 2: Pterygium operated.

Figure 3: Opacity due to corticosteroid therapy at 3 weeks post excision of stage II pterygium.

Figure 4: Good progress with treatment with mollusk shell extracts in the 3rd month of treatment.