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Impact of Contact Lens and other Eye Wears on Ocular Bacterial Contamination in Parts of South East Nigeria

O.U. Amaechi[1], A.O. Ebere[1], A.U. Omaka[1], A.C. Ezeigbo[1], C.A. Anonaba[1], C.G. Ezeagwula[2], F.U. Amaechi[3], and V.O. Nwaugo[4]

[1](Department of Optometry, Faculty of Health Sciences, Abia State University, Uturu, Abia State, Nigeria)
[2](Department of Microbiology, Faculty of Biological Sciences, Ogbonnaya Onu Polytechnic, Aba, Abia State, Nigeria)
[3](Department of Ophthalmology, Alex Ekwueme Federal Teaching Hospital, Abakiliki, Ebonyi State, Nigeria)
[4](Department of Microbiology, Faculty of Biological Sciences, Abia State University, Uturu, Abia State, Nigeria)

Abstract:
Background: *Contact lenses as medical devices can be used for vision correction, cosmetic purposes, amongst other uses. Other eye wears like mascara, eye extensions amongst others are utilized especially by females to enhance their beauty. These devices which have some contact with the eyes can predispose the wearer to bacterial contamination and this predisposition is worsened when these devices are administered by non-professionals as is the case with cosmetic contact lenses and other eye wears.*
Materials and Methods: *The effects of contact lenses and other eye wears on bacterial dynamics in South Eastern Nigeria were investigated using conventional culture techniques. The ocular fluids were collected using Schirmer's strips and cultured on various culture media.*
Results: *The bacterial species were Bacillus subtilis, Pseudomonas aeruginosa, Bacillus cereus, Escherichia coli, Enterobacter species and Staphylococcus aureus. Data generated in the work indicated that more females use the ocular wears and were significantly more infected than the males (P=0.05), especially the wears for fashion than for correction of ocular defects. Results indicated that ocular wears predisposed the users to bacterial contaminations and infections and that regular cleaning with solutions reduced the bacterial contaminations and infection. However, while females were more involved in the usage of these wears and were more infected than the males, age did not influence the bacterial contamination. The study also revealed that occupation played significant roles in the spread of bacterial ocular diseases as farmers, artisans and all those involved in soil related activities were significantly more infected. On the other hand, signs and symptoms were similar for the different bacterial species; but bacterial contaminations were more when ocular discharges, redness and pains were present than when nothing was observed. Further observations indicated that the bacterial agents were susceptible to commonly used conventional antibacterials.*
Conclusion: *Wearers of contact lenses and other eye wears had more bacterial ocular contamination than non-wearers. Proper cleaning with disinfection and application of the appropriate antibacterials are crucial in the prevention and treatment of these bacterials infections.*
Key Words: *Contact lens; Ocular wears; Bacterial contamination; Antibacterials; Cleaning solutions.*

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I. Introduction

In Nigeria, Contact lens practice is yet to gain acceptance as compared to the use of spectacle lenses. Some studies have estimated the use of contact lens as still low in Nigeria[1,2,3,4]. Apart from the availability of the instruments that are required for a successful contact lens practice and the cost burden, the entry of cosmetic contact lenses into the market has also polarized the entry points into the use of contact lenses. It has been shown that the medical device can be purchased even in the beauty shop without any input from the eye care professional, who *ab initio* would have done the necessary pre-contact lens fitting tests and counseling on the safe and appropriate use of contact lenses. With the exclusion of the eye care professional from the dispensing and sale of the contact lenses, it opens up the avenue for unsafe and wrong usage of contact lenses. The demographics and risk behaviors for contact lens-related eye infections are well documented in other climes[5]. The risk of contamination of contact lenses and the storage cases with *Acanthamoeba* species causing keratitis has also been investigated[6]; other microorganisms deemed to be potential pathogens include *Acinebacter, Escherichia, Klebsiella, Moraxella* and *Pseudomonas* species. Others include *Streptococcus, Staphylococcus,*

Norcardia, Candida species[7]. These organisms cause various types of ocular diseases and complications. The risk is more as the contact lenses would need to be removed, cleaned and re-inserted intermittently.

Contact lens wear is associated with a myriad of potentially harmful effects, when not properly taken care of and when personal hygiene on the use is not well followed. There is an increase in infectious keratitis among such defaulters[8]. The intact healthy cornea is impervious to bacteria, but with use of contact lens, the biochemical and biomechanical properties of the cornea would be altered allowing for a potential penetration of opportunistic and potentially pathogenic organisms leading to the development of various infections[9]. Some researchers stated that the effect of contact lens wear on normal ocular bacterial flora is also an important consideration, as the organisms produce antimicrobial factors which play a role in defense of the ocular tissues from infections[10,11]. A study suggested that there is an increase in the quantity of bacteria in the eye during hard contact lens daily wear, even by only after 6 months of use[12]. Normal conjunctival flora has been found to be preserved during therapeutic soft contact lens extended wear for the treatment of corneal disease[13,14,15]. There has been a continuous dispute among cosmetic soft contact lens and corrective contact lens wearers as to the nature of the changes in conjunctival microflora. Some research results indicate no change in bacterial loads[16], but some studies suggested reductions in ocular bacterial biodiversity[14,17,18,19]. However, some researchers have reported significant increases in change in the variety of microorganisms during contact lens uses[20,21].

The use of contact lenses is bound to grow eventually in both correction of refractive errors and cosmetic contact lens wear in Nigeria with time and awareness. The use of eye extensions and other eye wears is also on the rise, as the fashion trends continue to increase. The risk of infection and ultimately loss of vision stemming from unsafe use of the contact lenses and other eye wears, poor hygiene and poor disinfection protocols is a public health challenge to the optometrists in particular, the eye care practitioners in general and even the wearers themselves.

Since the contact lens wearer has to place the contact lens on the cornea with the fingers and a reversal on removing it, there is a high likelihood that there would be an inoculation of the eye with microorganisms, alien to the eye, some of which can be pathogenic. The case is the same for other eye wears which are often handled by non-health care professionals. The knowledge of the most likely and prevalent microorganisms in wearers of contact lenses and other eye wears would help eye-care professionals to catalogue this information and prepare them for outbreaks of such infections. In addition, results from this study would prompt wearers of such ocular wears to take precautionary measures against infections.

II. Materials and Methods

Study Design: The research was a prospective observational study which used the convenient sampling technique.

Study Location: The study location was Abia State University, Uturu Nigeria. The Optometry Clinic of the University which serves the South East zone of Nigeria was used as the reference clinic. This clinic handles both basic and referral ocular cases.

Study Duration: February 2020 to March 2021. Patients with various ocular diseases and complications relating to the use of contact lenses, who attended the health facility, were targeted over a period of fourteen months. Specimens were also collected from other patients who wore other ocular wears and individuals who wore nothing.

Sample size: Four hundred and thirty-two (432) subjects.

Sample size calculation: The purposive method of data collection was used, so no sample size calculation was done.

Subjects and selection method: All subjects who met with the purpose of the study for the 14 months duration of the study served as subjects.

Inclusion criteria: Subjects who wore contact lenses, subjects who used other ocular wears like mascara, eye extensions amongst others and subjects who wore nothing.

Exclusion criteria: Those who fitted into the inclusion criteria, but did not give their consent; were excluded from the study.

Procedure methodology

A well-structured questionnaire was used to collect data on demography, age, gender, educational level, occupation and other relevant information of the study population. The signs and symptoms experienced by the individuals examined were also recorded.

Specimen collection and culture

Schirmer's paper strips were used to collect tear fluid. The paper was placed underneath the lower eyelid to collect the tear fluid from each individual and allowed to stand for five to ten minutes. Specimens were sent to the laboratory in sealed dispensing plastic bags and the laboratory analyses were carried out immediately.

The Schirmer's strip specimens were placed on the media used which were nutrient agar for total heterotrophic bacteria, MacConkey agar for total coliforms and Blood agar for hemolytic reactions of the potentially pathogenic bacteria[22].

All these media were obtained in the hydrated form and prepared according to the manufacturer's instructions by reconstituting in distilled water and autoclaving appropriately. Both wet mount and culture techniques were used in the analysis of the specimens. Each Schirmer's paper was used to make a wet mount using physiological saline and viewed under x10 and x40 objectives lenses.

Culturing was done on the above mentioned culture media and observed for bacterial growth after 24 - 48 hours incubation at 37^{o}C. Pure isolation of the observed bacterial growth was done using the streaking technique of inoculation.

Haemolysis of the pure isolates was done by inoculating them on blood agar and observing the haemolysis pattern as alpha (α) hemolysis, beta (β) hemolysis or gamma (γ) hemolysis[23].

The observed bacteria were sub-cultured on various culture media to obtain pure isolates. These pure isolates were subjected to macroscopic, microscopic (after staining) and biochemical tests to characterize and identify the organisms. A few were subjected to molecular characterization and identification.

Antibiotic susceptibility testing

The pure Isolates obtained were subjected to antibiotic susceptibility tests using the disc agar diffusion technique. The inoculums were prepared to 0.5 McFarland standards and then 0.1ml was inoculated on freshly prepared Muller Hinton agar plates using spread plate technique. The diameters of zones of inhibition of the isolates were measured in mm after 24 hours incubation at 37^{o}C. This was classified as sensitive, moderate or resistant according to NCBI[24].

Statistical analysis

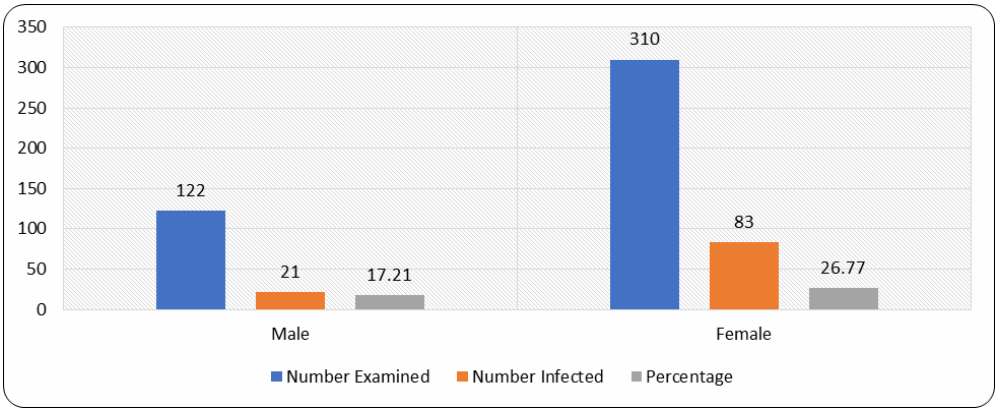
Data obtained in this study were analyzed using the SPSS statistical package (version 23). The Analysis of Variance statistical tool was used to test for significance. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration

Being a study involving humans, the written consent of the individual involved was obtained before the ocular tear specimens were taken. A research consent form was given to each participant to obtain full consent from them prior to the study and participation in the study was voluntary. Ethical clearance was obtained from the Research and Ethical Committee of Abia State University, Uturu, Nigeria.

III. Results

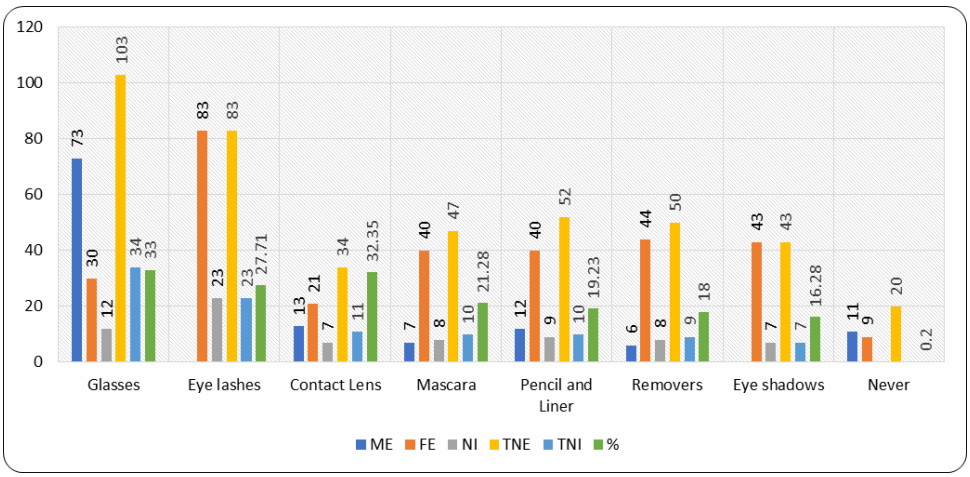
Figure 1: Shows the distribution of the isolates according to gender in the population investigated. There were more females (310, 71.76 %) than males (122, 28.24 %) who were screened depending on the attendance to the health facilities used for the study. Twenty one (17.21%) of the 122 males have bacterial infections. Among the females, 83(26.77%) have bacterial contamination.



TOTAL Number Examined: 432 Number Infected: 104 Percentage: 24.07

Figure1: Sample population and number with bacterial contamination

Figure 2: Shows the influence of ocular wears on the bacterial isolates. Persons that wear eye glasses have the highest percentage of bacterial contamination and the least are people who have never used anything on their eyes.



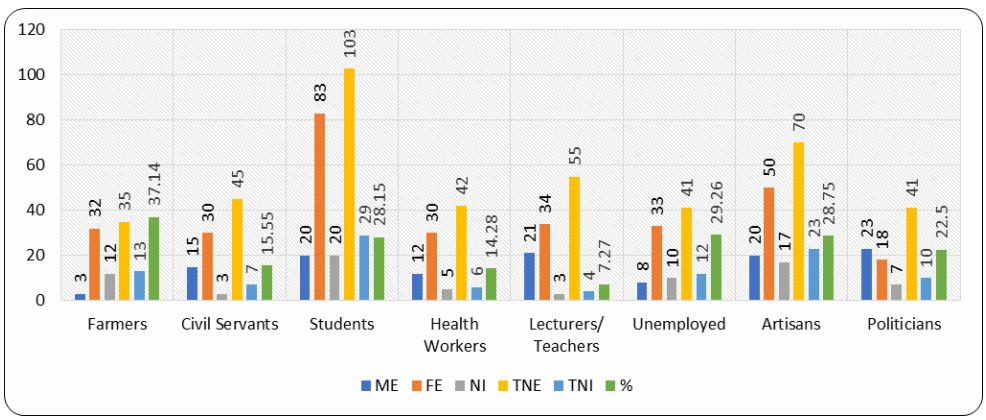
TOTAL ME:122 FE:310 NI: 74TNE: 432 TNI: 104 %: 24.07

Figure 2: Distribution of bacterial isolates in ocular wears

Keys:

TNE: Total Number Examined TNI: Total Number Infected NI: Number Infected ME: Male Examined FE: Female Examined %: Percentage

Figure 3: Shows the occupational influence on ocular bacterial contamination. The bacterial contamination is highest in farmers and lowest in lecturers/teachers.

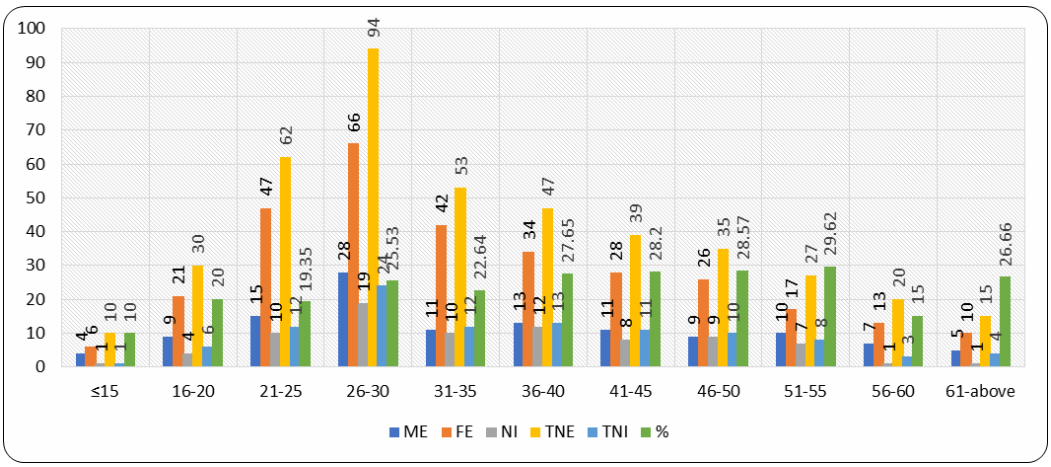


TOTAL ME: 122 FE: 310 NI: 77 TNE: 432 TNI: 104 %: 24.07

Figure 3: Occupational influence on ocular bacterial contamination.

Keys:
TNE: Total Number Examined TNI: Total Number Infected NI: Number Infected ME: Male Examined FE: Female Examined %: Percentage

Figure 4: Shows the age-related prevalence of ocular bacterial contamination. The age range of 51 – 55 years has the highest bacterial contamination, while the lowest is the age range of 15 years and below.

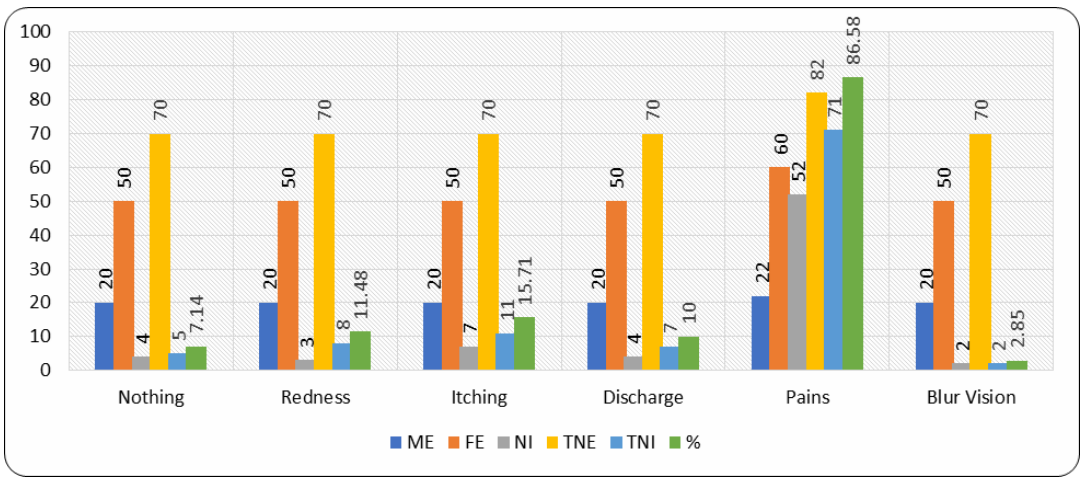


TOTAL ME: 122 FE: 310 NI: 82 TNE: 432 TNI: 104 %: 24.07

Figure 4: Age–related prevalence of ocular bacterial contamination

Keys:
TNE: Total Number Examined TNI: Total Number Infected NI: Number Infected ME: Male Examined FE: Female Examined %: Percentage

Figure 5: Shows the ocular presentations of infected individuals with bacterial contamination. Ocular pain is the highest symptom that was presented and the lowest is blur vision.



TOTAL ME: 122 FE: 310 NI: 72 TNE: 432 TNI: 104 %: 24.07

Figure 5: Ocular presentations of infected individuals with bacterial contamination

Keys:
TNE: Total Number Examined TNI: Total Number Infected NI: Number Infected ME: Male Examined FE: Female Examined %: Percentage

Table 1: Shows effect of cleaning products on glasses, eye lashes and contact lens on bacterial contamination (With cleaning solution). Soapy water has the highest percentage, while Yoogan cleaning solution has the lowest percentage with cleaning solution.

Table 1: Effect of Cleaning Products on Glasses, Eyelashes and Contact Lens on Bacterial Contamination (With Cleaning Solutions)

With Cleaning solutions	Daily						Weekly						Monthly						Unspecific						Never						TNE	TNI	%
	Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact				
	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI			
MFC	4	-	3	1	2	-	4	1	4	2	2	1	4	2	3	2	2	1	4	2	3	1	2	1	4	-	3	-	2	-	46	14	30.43
CTLC	4	-	4	-	2	-	4	1	3	1	2	1	4	1	3	1	2	1	4	1	3	1	2	1	4	-	3	-	1	-	45	9	20.00
YCL	4	-	3	-	1	-	4	1	3	1	1	-	4	2	3	1	1	-	4	2	4	1	1	1	4	-	3	-	1	-	41	9	21.95
CCS	4	-	4	1	1	-	5	2	4	1	1	-	5	2	4	1	1	-	4	2	4	1	1	1	5	-	4	-	1	-	48	11	22.91
SW	4	2	3	1	1	1	4	2	3	2	1	1	4	3	3	2	1	1	4	3	3	3	1	1	4	2	3	1	1	-	40	25	62.50
Total	20	2	17	3	7	-	21	7	17	7	7	3	21	10	16	7	7	3	20	9	17	6	7	6	21	2	16	-	6	-	220	68	30.90

Keys:

MFC: Micellar Foaming Cleanser CTLC: Care Touch Cleaning Solution YCL: Yoogan Cleaning Solution CCS: Cailiang Cleaning Solution SW: Soapy Water NE: Number Examined NI: Number Infected TNE: Total Number Examined TNI: Total Number Infected %: Percentage

Table 2: Shows the effect of cleaning period on glasses, eye lashes and contact lens on bacterial contamination (Without cleaning solutions). Handkerchief has the highest percentage and alcoholic wet pad has the lowest percentage.

Table 2: Effect of Cleaning Period on Glasses, Eyelashes and Contact Lens on Bacterial Contamination (Without Cleaning Solutions)

Without Cleaning solutions	Daily						Weekly						Monthly						Unspecific						Never						TNE	TNI	%
	Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact		Glasses		Eye lashes		Contact				
	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI	NE	NI			
MFC	4	-	3	1	2	-	4	1	4	2	2	1	4	2	3	2	2	1	4	2	3	1	2	1	4	-	3	-	2	-	46	14	30.43
LCRB	4	-	4	1	2	-	4	1	3	1	2	1	4	3	3	1	2	1	4	1	3	2	2	2	4	-	3	-	1	-	45	14	31.11
SALC	4	-	3	-	1	-	4	1	3	1	1	-	4	3	3	1	1	-	4	2	4	1	1	1	4	-	3	-	1	-	41	10	24.39
AWP	4	-	4	1	1	-	5	1	4	1	1	-	5	3	4	1	1	-	4	1	4	1	1	1	5	-	4	-	1	-	48	9	18.75
H	4	1	3	2	1	-	4	1	3	2	1	1	4	2	3	2	1	1	4	3	3	3	1	1	4	-	3	-	1	-	40	19	52.50
Total	20	1	17	5	7	-	21	5	17	7	7	3	21	13	16	7	3	20	9	17	6	7	6	21	2	16	-	6	-	220	66	30.00

Keys:

MFC: Microfiber cleaning cloth AWP: Alcoholic wet pad SALC: Suede anti-fog lens cloth

LCRB: Lens cleaning retractable brush H: Handkerchief NE: Number Examined

NI: Number Infected TNE: Total Number Examined TNI: Total Number Infected

%: Percentage

Figure 6: Shows bacterial isolates from each ocular presentation. Specimens from subjects who reported pains have the highest frequency of bacterial isolates in all categories, while no ocular presentation is the least.

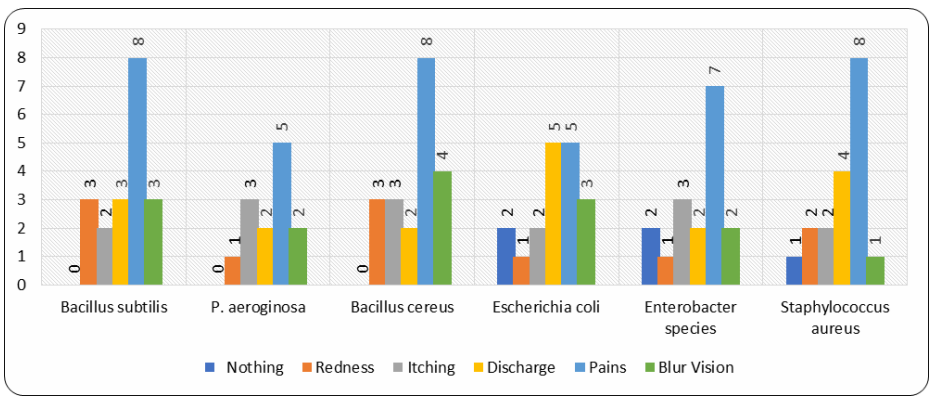


Figure 6: Bacterial isolates from each ocular presentation observed

Figure 7: Shows susceptibility of bacterial isolates to antibacterial agents. The bacterial isolates that were 90-100% sensitive to the antibacterial agents were: *Bacillus subtilis* and *Bacillus cereus* which were 100% sensitive to vancomycin, *Escherichia coli* and *Enterobacter* species which were 100% sensitive to chloramphenicol, and *Staphylococcus aureus* which was 90% sensitive to norfloxacin. *Pseudomonas aeruginosa* was not 90-100% sensitive to any of the antibacterial agents administered in the study.

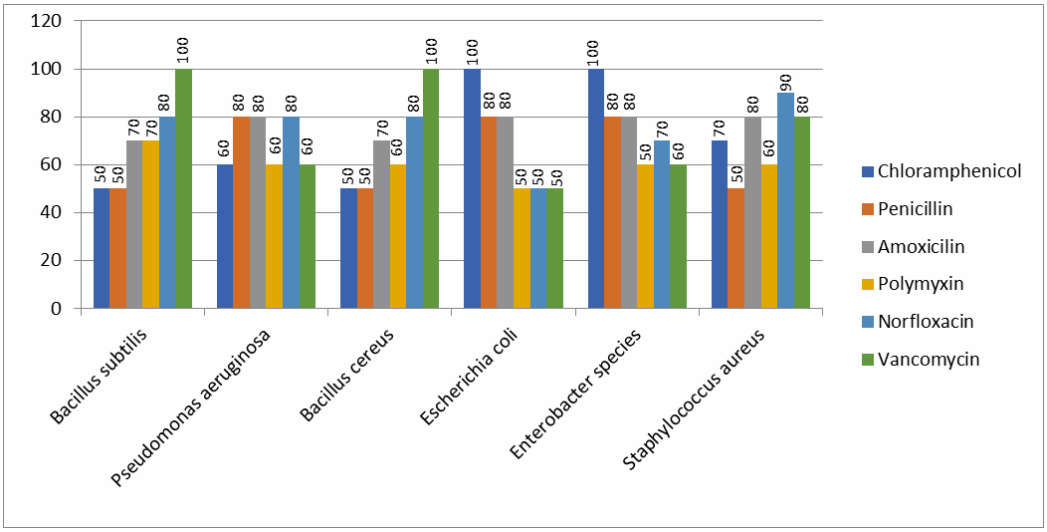


Figure 7: Susceptibility of bacterial isolates to antibacterial agents

IV. Discussion

The impact of contact lens and other eye wears on bacterial contamination of the eyes among patients accessing the Optometry Clinic facilities of Abia State University, Uturu was investigated using various techniques. Six (6) bacterial species were identified. The bacterial species were *Bacillus subtilis, Pseudomonas aeruginosa, Bacillus cereus, Escherichia coli, Enterobacter species* and *Staphylococcus aureus*. These organisms have been reported to be present in ocular specimens[25]. Some researchers had earlier reported the presence of some of these organisms on medicated glasses of staff and students of Michael Okpara University of Agriculture Umudike, Nigeria[26]. Some of these organisms are members of the normal microbiota of man example *Enterobacter* species, *Escherichia coli,* and *Staphylococcus* species.

Out of 432 individuals screened for ocular bacterial contamination, 104 (24.07%) had bacterial contamination. Osaro-Matthew *et al*.[26], in their study on the bacterial contamination of medicated glasses of staff and students of Michael Okpara University of Agriculture Umudike, Nigeria; reported that *Escherichia coli* had the highest prevalence, followed by *Staphylococcus aureus*, then *Streptococcus* species and *Pseudomonas aeruginosa*. Similarly, Stapleton *et al*.[27], in their study identified Gram-negative bacteria, fungi and *Acanthamoeba* to cause severe keratitis. The ocular wears assessed in this work havedirect contact with the eyes; like contact lenses, eye lashes/shadows, mascara amongst others; and can therefore contaminate the ocular tissues. Medicated glasses on the other hand are placed anywhere and everywhere, even on toilet wash hand basins from which they can also pick up contaminants.

Results obtained in this study indicated that more females than males have ocular bacterial contamination. This agrees with the observation that more females than males wear various ocular dressings. Females are generally known to be involved in different fashion-related issues including ocular wears. This observation is in line with analysis of the activities of those screened individuals, except the use of corrective glasses where more males than females were observed. All other activities assessed had more females than males. These include wearing of eye lashes, contact lenses, mascara, removers, eye shadows and the use of eye pencils and liners. These activities involve putting hands and objects to the eyes. Some of the hands and objects could be contaminated and putting them to the eyes may result in ocular contamination. Enitan *et al*.[28] and Fritz *et al*.[29], reported that contaminated eyeglasses act as formites and may lead to ocular contamination, which is not far from the observation in this study. Further assessment of the results showed that the most contaminative activity was contact lens wearing, followed by eye-lash usage, while the least was eye shadows. Since females (girls and women) indulge in these activities more than the males, it follows that they too would be more infected/ contaminated than the males (men).

This study showed significant occupational influence on the ocular bacterial contamination which tends to agree with Snyder and Glasser[30] and Alves *et al*.[31]. According to Snyder and Glasser[30], the spectra and prevalence of ocular infections within a community or geographic zone depend on many risk factors related to

patients, microbes and the environment, such as; virulence and drug-resistance of pathogens, the level of personal hygiene, socioeconomic status, nutrition, genetics, physiology, age, accessibility to healthcare facilities, exposure to pollutants, occupational risks, and co-morbidities. Environmental risk factors which include those that are climate-related like temperature, wind speed, allergens or those that are due to outdoor pollution like airborne pollutants have large impact on the ocular surface and can therefore predispose them to contamination[31]. People who engaged in farming activities, artisanal activities and students had more contaminations; while health workers had the least ocular contamination. This observation could be attributed to two things – awareness and closeness to the microbial agents. Lecturers/teachers and health workers could be said to be aware of the danger posed by these microorganisms and so took steps to avoid contamination. On the other hand, farmers, artisans and students had activities that bring them in contact with many microorganisms. Farmers till the soil and raise dusts, artisans do many things that cause microorganisms to get stirred upwards and the unemployed engage in multiple activities to make a living. All these activities bring them in close proximity with bacterial organisms, hence the contamination.

Observations in this study indicated that individuals who are 15 years and below (10.0%) had the least bacterial infections, followed by the 56 – 60 years (15%). All the other age brackets did not show statistical differences. This suggests that age did not play much significant roles in the bacterial infections. This indicates that contamination was evenly distributed and that age did not play significant role in the ocular contamination. Holden *et al*.[32] and Maharana *et al*.[33], stated that microbial ocular pathogens have the potential to cause infections in any individual once they gain entry into the eyes; no matter the age or gender. Rubio *et al*.[34], observed that there are less immunological defense substances in the eyes; hence organisms that colonize the eyes remain there for long; except when treated.

Data obtained from the study indicate that people with ocular bacterial infection suffer from similar symptoms. No sign or symptom remains exclusive for certain bacterial organisms. However, some ocular presentations are found more in one type of organism than the other. Pain (86.5%) was the most outstanding presentation, while blurred vision was the least. Redness, itching and ocular discharge did not show any statistical difference. Those with no notable ocular presentations had scanty microbial growth which could be claimed to be new infections. These observations indicate that ocular bacterial infections usually manifested by some symptoms and signs, except in new infections. This implies that once there is any deviation from the normal appearance of the eyes, microbial infection remains the first suspicion to check for. Parrey *et al*.[35]and Sharma *et al*.[36], stated that ocular microbial infections quickly become visible due to ulceration and penetration of the cornea. Ray and Lim[37], agree that the enzymes secreted by these microorganisms cause the distortion of the normal eye surfaces giving rise to the signs and symptoms experienced by patients. It is important therefore to diagnose ocular microbial infections properly before treatment.

In assessing the effects of cleaning and cleaning tools against ocular bacterial contamination of wears (glasses, eye lashes and contact lenses) two aspects were used - those with solutions and those without solutions (brushes and cloths). Among the tools used, the agents with solution reduced or removed bacterial contaminations more than dry cloth or brush. The Alcohol wet pad, Care-touch-cleaning solutions and Cailiang cleaning solution reduced much of the contamination of the glasses, eye lashes and contact lens. This suggests that the solutions used in conjunction with pads or other soft linen removed bacterial contamination. This is similar to physical cleaning with cloth and antimicrobial solution. The solutions could cause the death or enhanced removal of the microorganisms e.g. the alcohol wet pad. Alcohol has been used as a disinfectant for ages. Using it in the cleaning of the ocular wears is actually a disinfecting process, hence the low microbial status after such cleaning. Tankhiwale *et al*.[38] and Weisbarth *et al*.[39], agree that cleaning solutions helped to decontaminate contact lens surfaces in addition to preventing microbial ocular colonization. Those who cleaned the contact lenses, eye lashes and glasses weekly had fewer ocular infections, compared to those who did so monthly or did not clean them at all. This suggests that regular cleaning helps to decontaminate ocular wears and should be encouraged. Bacterial species on these ocular wears were reduced by the cleaning process.

Observations in this study show that the antibacterial agents tested against the bacterial species had varying degrees of potency. No antibiotic showed 100% efficiency against all the bacterial isolates. *Bacillus subtilis* and *Bacillus cereus* were 100% sensitive to vancomycin, *Escherichia coli* and *Enterobacter* species were 100% sensitive to chloramphenicol and *Staphylococcus aureus* was 90% sensitive to norfloxacin; while *Pseudomonas aeruginosa* was not 90-100% sensitive to any of the antibacterial agents administered in the study. Vancomycin had 100% efficiency against *Bacillus substilis* and *Bacillus cereus*. Chloramphenicol had 100% efficiency against *Escherichia coli* and *Enterobacter* species. Norfloxacin had 90% efficiency against *Staphylococcus aureus.* Further observation shows that penicillin, amoxicillin and polymixin did not have complete inhibition on any bacterial isolates. Chloramphenicol, Norfloxacin and Vancomycin are the drugs of choice in bacterial ocular infections.

V. Conclusion

Results obtained in this work indicate that ocular wears predisposed the users to bacterial contaminations and infections and that regular cleaning with solutions reduced the bacterial contaminations andlinfections. However, while females were more involved in the usage of these wears and were more infected than the males; age did not influence the ocular bacterial conditions. The study also revealed that occupation played significant roles in the spread of bacterial ocular diseases as farmers, artisans and all those involved in soil related activities were significantly more infected.

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References

[1] Amaechi OU, Nwokeocha E. The level of contact lens practice in Port Harcourt, Rivers State of Nigeria. Journal of the Nigerian Optometric Association. 2010; 15: 16-19.
[2] Binder PS, Worthen DM. A continuous-wear hydrophilic lens. Prophylactic topical antibiotics. Archives of Ophthalmology. 1976; 94: 2109-2111.
[3] Callender MG, Tse LS, Charles AM, Lutzi D. Bacterial flora of the eye and contact lens. Cases during hydrogel lens wear. American Journal of Optometry and Physiological Optics. 1986; 63(3):177-180. Doi: 10.1097/00006324-198603000-00002. PMID: 3515954.
[4] Cope JR, Collier SA, Maya MR, Chalmers R, Mitchell GL, Richdale K. et al. Contact lens wearer demographics and risk behaviors for contact lens related eye infections-United States, 2014. Morbidity and Mortality Report. 2015; 64(32): 865-870.
[5] Fleiszig SM, Efron N, Pier GB. Extended contact lens wear enhances Pseudomonas aeruginosa adherence to human corneal epithelium. Journal of Investigative Ophthalmology and Vision Science. 1992; 33(10):2908-16. PMID: 1526741
[6] Fleiszig SM, Efron N. Microbial flora in eyes of current and former contact lens wearers. Journal of Clinical Microbiology. 1992;30(5):1156-1161. Doi: 10.1128/Jcm.30.5.1156-1161.1992. PMID: 1583113; PMCID: PMC265241.
[7] Grosvenor T, Charles A, Callender M. Soft contact lens bacteriological study: A progress report. Canadian Journal of Optometry. 1972; 31: 11-18
[8] Halbert SP, Swick LS. Antibiotic-Producing bacteria of the ocular flora. American Journal of Ophthalmology. 1952; 35(52): 73-81.
[9] Høvding G. The conjunctival and contact lens bacterial flora during lens wear. Acta Ophthalmologica. 1981; 59: 387-401.
[10] Høvding G. Conjunctival and contact lens bacterial flora during continuous 'bandage' lens wear. Acta Ophthalmologica. 1982; 60: 439-448.
[11] Jensen OL, Gluud BS. Bacterial growth in the conjunctival sac and the local defence of the outer eye. Acta Ophthalmologica. 1985; 63(S173):80-82.
[12] Kapetansky FM, Suie T, Gracy AD, Bitonte JL. Bacteriologic studies of patients who wear contact lenses. American Journal of Ophthalmology. 1964; 57: 255-258.
[13] Mcbride ME. Evaluation of microbial flora of the eye during wear of soft contact lenses. Applied Environmental Microbiology. 1979; 37(2): 233-6. Doi: 10.1128/Aem.37.2.233-236.1979. PMID: 434806; PMCID: PMC243193.
[14] Oghre E. Trends in contact lens practice in Nigeria (1994-2000). AFSCOPE, Journal of the African Council of Optometry (AFCO). 2004; 1(1): 50-54.
[15] Rydberg M. Bacteriology in continuous wearing of soft contact lenses. Eye and Contact Lens…Contact and Intraocular Lens Medical Journal. 1975; 1(1): 150-152.
[16] Schein OD, Glynn RJ, Poggio EC, Seddon JM, Kenyon KR. The relative risk of ulcerative keratitis among users of daily-wear and extended-wear soft contact lenses. A case-control study. Microbial Keratitis Study Group. N England Journal of Medicine. 1989; 321(12):773-778. Doi: 10.1056/NEJM198909213211201. PMID: 2671733.
[17] Smolin G, Okumoto M, Nozik RA. The microbial flora in extended-wear soft contact-lens wearers. American Journal of Ophthalmology. 1979; 88(3 Pt2):543-547. Doi: 10.1016/0002-9394(79)90512-9. PMID: 484683.
[18] Tragakis MP, Brown SI, Pearce DB. Bacteriologic studies of contamination associated with soft contact lenses. American Journal of Ophthalmology. 1973; 75(3):496-499. Doi: 10.1016/0002-9394(73)91164-1. PMID: 4633237.
[19] Ukwade MT. Contact lens practice in Nigeria. The Contact Lens Journal. 1986; 14(10): 3-5.
[20] Ukwade MT. Viability of contact lenses as a mode of correction in Nigeria. Journal of the Nigerian Optometric Association. 1987; 3 (1): 19-21.
[21] Verani JR, Lorick SA, Yoder JS, Beach MJ, Braden CR, Roberts JM, Conover CS, Chen S, McconnellKA, Chang DC, Park BJ, Jones DB, Visvesvara GS, Roy SL; Acanthamoeba Keratitis Investigation Team. National Outbreak Of Acanthamoeba Keratitis Associated with use of a Contact Lens Solution, United States. Emerging Infectious Diseases. 2009; 15(8):1236-42. Doi: 10.3201/Eid1508.090225. PMID: 19751585; PMCID: PMC2815976.
[22] Elazhary MA, Saheb SA, Roy RS, Lagacé A. A simple procedure for the preliminary identification of aerobic Gram negative intestinal bacteria with special reference to the Enterobacteriaceae. Canadian Journal of Comparative Medicine. 1973; 37(1):43-6. PMID: 4265552; PMCID: PMC1319723.
[23] Buxton R. Blood agar plates and hemolysis protocols. American Society for Microbiology. 2016: 1-9.
[24] National Center ForBiotechnology Information (NCBI).
[25] Teweldemedhin M, Gebreyesus H, Atsbaha AH, Asgedom SW, Saravanan M. Bacterial profile of ocular infections: A systematic review. BMC Ophthalmology. 2017; 17(1):212. Doi: 10.1186/S12886-017-0612-2. PMID: 29178851; PMCID: PMC5702129.
[26] Osaro-Matthew RC, Okorie PI, Ohabasirim NA. Bacterial contamination of medicated glasses amongst staff and students of Michael Okpara University of Agriculture Umudike, Nigeria. The International Journal of Science &Technoledge. 2015; 3(9). Retrieved From Https://Internationaljournalcorner.Com/Index.Php/Theijst/Article/View/124820
[27] Stapleton F, Edwards K, Keay L, Naduvilath T, Dart JK, Brian G, Holden B. Risk factors for moderate and severe microbial keratitis in daily wear contact lens users. Ophthalmology. 2012; 119(8):1516-21. Doi: 10.1016/J.Ophtha.2012.01.052. Epub2012 Apr 21. PMID: 22521083.

[28] Enitan SS, Edafetanure-Ibeh OM, Itodo GE, Dada MO, Mensah-Agyei GO, Akele RY, Makanjuola SO, Ajike SO, Ogbonna NI, Olalekan JM. (2022). Bacterial pathogens associated with eyeglasses and risks of infection: A cross-sectional study in South-West Nigeria. Trends in Infection and Global Health. 2022; 2(2): 47-60. Https://Doi.Org/10.24815/Tigh.V2i2.28488.

[29] Fritz B, Jenner A, Wehl S, Lappe C, Zehender A, Horn C, Blessing F, Kohl M, Ziemssen F, Egert M. A view to a kill?-Ambient bacterial load of frames and lenses of spectacles and evaluation of different cleaning methods. PlosOne. 2018; 13(11): E0207238.Doi:10.1371/Journal.Pone.0207238

[30] Snyder RW, Glasser DB. Antibiotic therapy for ocular infection. The Western Journal of Medicine. 1994; 161(6):579-584. PMID: 7856158; PMCID: PMC1022739.

[31] Alves M, Asbell P, Dogru M, Giannaccare G, Grau A, Gregory D, Kim DH, Marini MC, Ngo W, Nowinska A, Saldanha IJ, Villani E, Wakamatsu TH, Yu M, Stapleton F. TFOS Lifestyle Report: Impact of Environmental Conditions on the Ocular Surface. The Ocular Surface. 2023; 29:1-52. Doi: 10.1016/J.Jtos.2023.04.007. Epub2023 Apr 14. PMID: 37062427.

[32] Holden BA, Sweeney DF, Sankaridurg PR, Carnt N, Edwards K, Stretton S, Stapleton F. Microbial keratitis and vision loss with contact lenses. Eye & Contact Lens. 2003; 29(1 Suppl):S131-134; Discussion S143-4, S192-4. Doi: 10.1097/00140068-200301001-00035. PMID: 12772749.

[33] Maharana PK, Sharma N, Nagpal R, Jhanji V, Das S, Vajpayee RB. Recent advances in diagnosis and management of mycotic keratitis. Indian Journal of Ophthalmology. 2016; 64(5):346-57. Doi: 10.4103/0301-4738.185592. PMID: 27380973; PMCID: PMC4966371.

[34] Rubio FG, Oliveira VD, Rangel RM, Nogueira MC, Almeida MT. Trends in bacterial resistance in a tertiary university hospital over one decade. The Brazilian Journal of Infectious Diseases. 2013; 17(4):480-482. Doi: 10.1016/J.Bjid.2012.12.004. Epub2013 Jun 21. PMID: 23797009; PMCID: PMC9428047.

[35] Parrey AH, Sofi F, Ahmad M, Kuchay A. AerococcusViridans infection presenting as cutaneous vasculitis in an immunocompetent patient. Reumatologia. 2016; 54(6):318-320. Doi: 10.5114/Reum.2016.64909. Epub2016 Dec 30. PMID: 28115783; PMCID: PMC5241369.

[36] Sharma S, Taneja M, Gupta R, Upponi A, Gopinathan U, Nutheti R, Garg P. Comparison of clinical and microbiological profiles in smear-positive and smear-negative cases of suspected microbial keratitis. Indian Journal of Ophthalmology. 2007; 55(1):21-5. Doi: 10.4103/0301-4738.29490. PMID: 17189882.

[37] Ray M, Lim DK. A rare polymicrobial keratitis involving Chryseobacterium meningosepticum and Delftia acidovorans in a cosmetic contact lens wearer. Eye &Contact Lens. 2013; 39(2):192-193. Doi: 10.1097/ICL.0b013e3182448881. PMID: 22223162.

[38] Tankhiwale SS, Dwldhmuthe S, Tankhiwale NS. (2015). Risk factors and microbial colonization of soft contact lens storage cases and conjunctiva of asymptomatic lens users. International Journal of Applied Microbiology and Biotechnology Research. 2015; 3: 31-35.

[39] Weisbarth RE, Gabriel MM, George M, Rappon J, Miller M, Chalmers R, Winterton L. Creating antimicrobial surfaces and materials for contact lenses and lens cases. Eye & Contact Lens. 2007; 33(6 Pt2):426-9; Discussion 434. Doi: 10.1097/ICL.0b013e318157f488. PMID: 17975440.