NATIONAL OPEN UNIVERSITY OF NIGERIA

COURSE CODE: NSC511

COURSE TITLE: Ophthalmology Nursing

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NSS 513: OPHTHALMOLOGY IN NURSING (3CU)

COURSE GUIDE

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1.0 Introduction

This course is titled Ophthalmology in Nursing. It presents an overview of the anatomy and physiology of the human eye, examines common ailments related to each of the component of the eyes, how an injured eye or any conditions related to the eye are treated and the effects of ageing on the eyes. The course aims to provide students with knowledge, attitude and specific skills involved in caring for clients with eyes diseases and injuries. Students are expected to nurse client in the specialized unit associate with eyes problem or diseases.

NSC511: Ophthalmology in Nursing is a three credit unit course for students in the Bachelor of Nursing Science programme. It is one of the electives in the second semester of the final year.

The course is broken to 5 modules with 20 study units. This course will introduce students to the anatomy and physiology of the human eye, examines common ailments related to each of the component of the eyes, how an injured eye or any conditions related to the eye are treated and the effects of ageing on the eyes. The course aims to provide students with knowledge, attitude and specific skills involved in caring clients with eyes diseases and injuries at all levels of health care.

Students are expected to nurse client in the specialized unit associate with eyes problem or diseases. At the end of the course, the learner is expected to demonstrate clear understanding of basic eye conditions and provide primary eye care service.

This course guide provides you with what to expect in the course, how to work through the course material as a distance learner saddled with the responsibility of studying on your own and your overall responsibilities and expectations. Tutorial sessions are also linked up with the course to provide the needed support you required.

2.0 Course Competencies

Today, Nigeria has a growing population of about 216.7 million people majority of who are in the rural areas. There is still a great imbalance in the provision of medical care facilities and it has become a great challenge to provide same for the larger population. The overall aim of this course NSC511: Ophthalmology in Nursing is to provide learners with proper understanding of this special sense organ whose major function is to provide light to the entire body with in-depth understanding of eye defects and the need for prompt care whenever the need arises. It is hoped that you will be better equipped to contribute meaningfully to health living for all and sundries.

3.0 Course learning Outcome

To achieve the aims set out above, the course sets the overall objective. In addition, each unit has specific learning outcomes stated at the beginning of a unit. Learners are advised to read them carefully before going through the unit. You will have to refer to them during the course of your study to monitor your progress. You are encouraged to always refer to the Unit learning outcome after completing a Unit. This is the way you can be certain that you have done what was required of you in the unit.

The wider objectives of the course are set below. By meeting these objectives, you should have achieved the aims of the course as a whole.
On successful completion of the course, you should be able to:

- Understand who the ophthalmic patient and ophthalmic nurse is.
- Understand the basic anatomy and physiology of the human eye
- Identify and explain common ailments related to the outer, middle and inner layer of the eyes.
- Understand common diseases and disorders of the Cornea
- Be able to answer some basic questions in relation to eye.
- Discuss the effect of ageing on the Eye.
- Explain the Non-Penetrating and Penetrating Injuries/Wound of the Eye Ball
- Describe the general rules of Eye Care

4.0 Working through This Course

To complete this course, you are required to study through the units, the recommended textbooks and other relevant materials. Each unit contains some self-assessment exercises and tutor marked assignments and at some point in this course, you are required to submit the tutor marked assignments. This will be followed by an end of semester examination.

5.0 Study Units

Unit 1: The Ophthalmic Patient
Unit 2: The Ophthalmic Nurse
Unit 3: Ophthalmic Nursing Procedures
Unit 4: Diagnostic Assessment for Condition of the Eye
Unit 5: Anatomy and Physiology of the human eye
Unit 6: The Muscles of the human eye
Unit 7: Basic refraction
Unit 8: Common Ailments related to the outer layer of the eyes
Unit 9: Common Ailments related to the middle layer of the eyes
Unit 10: Common Ailments related to the inner layer of the eyes
Unit 11: Common diseases and disorders of the Corneal
Unit 12: Retinal problems
Unit 13: Macular Degeneration
Unit 14: Ophthalmic puzzles
Unit 15: Neuro-ophthalmology
Unit 16: Effect of Ageing on the Eye
Unit 17: Wound of the Eye Ball
Unit 18: Non-Penetrating Injuries
Unit 19: Penetrating Injuries
Unit 20: General Rules of Eye Care

6.0 References and Further Readings

Crick, R. P & Khaw, P. T. (2003) A Textbook of Clinical Ophthalmology. A Practical Guide to Disorders of the Eyes and Their Management. (3rd Edition). World Scientific.
Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.
James, B., Chew, C. & Bron, A. (2003). Lecture notes on Ophthalmology. (9th Ed) Blackwell Scientific Publications).
Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell
Smelter, S. C & Bare, B. G. (2014). Brunner & Suddarth's Textbook of Medical-Surgical Nursing (10th edition). Lippincott Williams.
Stein, H. A., Stein, R. M. & Freeman, M. I. (2013). The Ophthalmic Assistant A Text for Allied and Associated Ophthalmic Personnel. Elsevier Saunders.
Waugh, A. & Grant, A. (2010). Ross and Wilson Anatomy and physiology in Health and Illness. (11th Edition). Churchill Livingstone.

7.0 Assignment File

The assignment file will contain the Tutor Marked Assignment (TMA) which will constitute part of the continuous assessment (CA) of the course. There are 15 assignments in this course with each unit having an activity/exercise for you to do to facilitate your learning as an individual.

Presentation Schedule

This presentation schedule in this course provides with important dates for completion of each tutor marked assignment. Please try to meet the deadlines.

Assessment

There are two aspects to the assessment of the course. These are the Tutor marked assignment and written examination. In tackling the assignments, you are expected to apply information, knowledge and strategies gathered during the course. The assignments must be turned in to your tutor for formal assessment in accordance with the stated presentation schedules. The works you submit to your tutor for assessment will count for 30% of your total course work. At the end of the course you will need to sit for a final written examination of three hour's duration. This examination will also count for 70% of your total course mark.

How to get the Most from the Course

In distance learning, the study units replace the university lecture. This is one of the greatest advantages of distance learning. You can read and work through specially

designed study materials at your own pace and at time and place that suit you best. Think of it as reading the lecture notes instead of listening to a lecturer.
In the same way that a lecturer might set you some reading task, the study units tell you when to read your other material. Just as a lecturer might give you an in-class exercise, your study units provide exercise for you to do at appropriate points.

Online Facilitation

What is online facilitation? To answer this question, refresh your mind on the meaning of facilitation. Facilitation could mean assistance, enabling or help. So, if you are facilitating it means you will be provided with assistance or help. This can be done through face-to-face or virtual. Our focus in this course is on the virtual. To facilitate online means providing a guide/assistance to the learner(s).

8.0 Tutor Marked Assignment (TMA)

There Tutor-marked assignments in the each of the unit of this course. You are advised in your own interest to attempt and go through all the assignments at your own pleasure. You will be able to complete the assignments from the information and materials contained in your reading and study units. Those to be submitted for evaluation will be communicated to you through the Study Centre. There is other self-activity contained in the instructional material to facilitate your studies. Try to attempt it all. Feel free to consult any of the references to provide you with broader view and a deeper understanding of the course.

9.0 Final Examination and Grading

The final examination of NSC511 will be of 2 hours duration and have a value of 70% of the total course grade. The examination will consist of questions which have bearings with the attempted self-assessment exercises and tutor marked that you have previously encountered. Furthermore, all areas of the course will be evaluated. Make sure you give enough time to revise the entire course.

Course Marking Scheme

The following table includes the course marking scheme

Table 1

Assessment	Marks
Assignment 1 – 10	10 assignments for the best 3
	Total = 10% x 3 = 40%
Final examination	70% of overall course marks
Total	100% of course marks

10.0 Course Overview

This table indicates the units, the number of weeks required to complete the assignments.

Unit	Title of Work	Week Activity	Assessment
	Course Guide		
Module 1	**Introduction**		
Unit 1 Unit 2 Unit 3 Unit 4	The Ophthalmic Patient The Ophthalmic Nurse Ophthalmic Nursing Procedures Diagnostic Assessment for Condition of the Eye	Week 1 Week 1 Week 2 Week 2	
Module 2	**Basic anatomy and physiology of the Eye**		
Unit 5	Anatomy and Physiology of the human eye	Week 2	
Unit 6	The Muscles of the human eye	Week 3	
Unit 7	Basic refraction	Week 3	
Module 3	**Common Ailments of the Eye**		
Unit 8	Common Ailments related to the outer layer of the eyes	Week 4	
Unit 9	Common Ailments related to the middle layer of the eyes	Week 5	
Unit 10	Common Ailments related to the inner layer of the eyes	Week 6	
Unit 11	Common diseases and disorders of the Corneal	Week 6	
Module 4	**Changes in the Eye**		
Unit 12	Retinal problems	Week 7	
Unit 13	Macular Degeneration	Week 8	
Unit 14	Ophthalmic puzzles	Week 8	
Unit 15	Neuro-ophthalmology	Week 9	
Unit 16	Effect of Ageing on the Eye	Week 9	
Module 5	**Wound of the Eye and Basic Care**		
Unit 17	Infection control in ophthalmology	Week 10	
Unit 18	Non-Penetrating Injuries/Trauma of the Eye	Week 10	
Unit 19	Penetrating Injuries/Trauma of the Eye Ball	Week 11	
Unit 20	General Rules of Eye Care	Week 11	

11.0 How to get the most out of the course

In distance learning, the study units replace the university lecture. This is one of the greatest advantages of distance learning. You can read and work through specially

designed study materials at your own pace and at time and place that suit you best. Think of it as reading the lecture notes instead of listening to a lecturer.
In the same way that a lecturer might set you some reading task, the study units tell you when to read your other material. Just as a lecturer might give you an in-class exercise, your study units provide exercise for you to do at appropriate points. The following are practical strategies for working through the course:

- Read the course guide thoroughly.
- Organize a study schedule.
- Stick to your own created study schedule.
- Read the introduction and objectives very well.
- Assemble your study materials.
- Work through the unit.
- Keep in mind that you will learn a lot by doing all your assignment carefully.
- Review the stated objectives.
- Don't proceed to the next unit until you are sure you have understood the previous unit.
- Keep to your schedules of studying and assignments.
- Review the course and prepare yourself for the final examination.

12.0 Tutors and Tutorials

There are 8 hours of effective tutorial provided in support of this course. Details will be communicated to you together with the name and phone number of your facilitator through the study centre.
Your tutor will mark and comment on your assignments, keep a close watch on your progress and any difficulties you might encounter and also provide assistance to you during the course. You must ensure that you submit your assignment as and at when due. You will get a feedback from your tutor as soon as possible to the assignments.
Do not hesitate to contact your tutor or study centre on phone or email in case of any of the following circumstances:

- You do not understand any part of the study units or the assigned reading
- You have difficulty with the self-test or exercises.
- You have questions or problems with an assignment, tutors comments or grading of an assignment.

You are encouraged to attend the tutorials to allow for face to face contact with your tutor and ask questions which you needed answers immediately. It is also an opportunity to discuss any grey area with your tutor. You can equally prepare questions to the tutorial class for meaningful interactions. You are sure to gain a lot from actively participating in the discussion.
Best of Luck.

Module 1

Unit 1: The Ophthalmic Patient

1.1 Introduction

The ophthalmic patient may be of any age and from any background. Ophthalmic conditions affect all age groups – ranging from a few days to more than 100 years old – although, in most ophthalmic settings, the majority of patients seen are elderly. Infants and children will have parents or guardians who wish to be involved in their child's care. The infant or child whose parents or guardians are either unable or unwilling to become involved will need the extra care and attention of a nurse to reassure him in unfamiliar and possibly frightening surroundings.

The ophthalmic patient may have other diseases such as diabetes mellitus (Type 1 or Type 2), ankylosing spondylitis or arthritis, as these conditions have ocular manifestations. He may also suffer from unrelated diseases. Patients with co-morbidity can be challenging for the ophthalmic nurse who will have to make decisions about care and management based on need.

Many people with learning disabilities are known to have ocular problems, including: visual impairment, refractive errors, squint, keratoconus, nystagmus, cataract and glaucoma. They face more problems than most members of society, including having difficulty accessing services when disease is detected, and few ophthalmic nurses have training specifically designed to meet the needs of these people.

1.2 Learning Outcomes

By the end of this unit, you will be able to:

- Identify Ophthalmic Patient and their respective needs/problems.
- Assess resources available for their utilization.

1.3 The Ophthalmic Patient

The ophthalmic patient will arrive at the eye hospital or unit either as a referral to the outpatient department or as a casualty, where many are self-referred and may not be 'emergencies' as such. They will present with a variety of conditions, from a lump on the lid to sudden visual loss or severe ocular trauma. In addition, the ophthalmic patient may access care via walk-in centres, NHS direct, the high street optometrist or GP services, including the practice nurse.

Most people will be anxious on a first visit to a hospital or other health care setting. Even for the elderly but otherwise fit person, it might be his first experience of a hospital. Those arriving following trauma will be in varying degrees of shock depending on the nature and type of accident and they, and their relatives, may be very anxious. Something that seems fairly minor to the nurse with ophthalmic knowledge may, to the layman, appear serious and be thought to threaten sight.

Many people have a fear of their eyes being touched, making examination difficult. Some feel faint – or do faint – while certain procedures, such as removal of a foreign body, are being performed.

There are some old wives' tales about the eye. One of the most common is that the eye can be removed from the socket for examination and treatment, and be replaced afterwards. This kind of false information does not help the patient's frame of mind.

Each person will arrive at the hospital with his own individual personality and past experience to influence any attitude towards the eye condition. Some will be enduring, others extremely tense. Those with chronic or recurrent eye conditions may become more accustomed to visiting the eye hospital. Most patients having ophthalmic surgery are outpatients, day cases or overnight stay patients. This means they have a very short time to adjust to the hospital setting and have little time to ask the questions that may be initially forgotten in the midst of all the activity. They may feel reluctant to express minor concerns when there appears to be little contact time with nurses.

The actual visual impairment experienced by the patient will vary with the eye condition. With many conditions there is no, or only slight, visual impairment and this may be temporary. Other conditions cause gross visual loss that may have occurred suddenly or gradually over the years. This visual loss may be untreatable and permanent, may be progressive, or sight may be restored.

Some patients will have only one eye affected and others both eyes, probably to different degrees. Some will have blurred vision; some will only be able to make out movements. Others will be able to differentiate only between light and dark, or will see nothing at all. Some will have lost their central vision, others their peripheral vision. A number of patients will see better in bright light than dim light, and vice versa. Some degree of visual loss can be very upsetting to the patient and can prove to be a severe impairment to daily living. All patients experiencing severe visual loss will require practical and emotional help in coming to terms with their loss, regardless of the cause and the course it has taken.

Self-Assessment Exercises 1

Fill the gap with correct answer for question 1; write true or False for question 2.

1. Some ophthalmic conditions may be related to some systemic diseases such as _____ and _____.

2. In the United Kingdom, registration of the blind and partially sighted people residing in their area is compulsory. True/False

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

1.4 Registration for the sight-impaired or severely sight-impaired

Research carried out by the Royal National Institute for the Blind (RNIB) (Bruce et al., 1991) suggested that there are three times more people eligible for registration as sight-impaired or severely sight-impaired than are in fact registered.

There is no reason to suppose that this situation has changed. People are reluctant to take the final step as it can appear to be the giving up of any hope that treatment will help. This need not be the case, however: sight-impaired or severely sight-impaired registration can be a much more liberating experience for many as they realise, with help and support, that they can maximise their quality of life. Being registered blind or severely sight-impaired can give access to a variety of benefits, including tax allowance; parking concession (blue badge) and a 50% reduction in TV licence fee.

1.5 Assistance and rehabilitation

In the United Kingdom, the National Assistance Act 1948 directed all local authorities to compile a register of blind and partially sighted people residing in their area and to provide advice, guidance and services to enable them and their families to maintain their independence and to live as full a life as possible.

Registration is voluntary. People can choose to register but, if they do so, they can have their names removed from the register at any time should they wish. The local authority has the responsibility of reviewing the register regularly and updating the circumstances of the people on it. Local authorities must offer services to all those identified as visually impaired, whether they choose to register or not. However, registration is necessary to qualify for certain financial benefits and for help from the many voluntary organisations such as the National Library for the Blind. Registration is a good guide as to whether a person is coming to terms with their sight loss.

The process of registration starts with the ophthalmologist certifying on a form. A new system for registering as blind was introduced in England and Wales in November 2003 (Shaw, Lee, & Stollery, 2010). It is claimed that the new system is easier to use and will speed up the process.

By signing the form, the patient is agreeing for their information to be shared with their local social services, general practitioner and the Department of Population Census, which maintains records of all those opting to share this information.

The Social Services Department has the responsibility for registering people. Some social services departments have delegated this task to their local voluntary organisation that deals with the blind and partially sighted people within their area. The role of the social worker is that of counsellor, providing support and information about the services available. Such services include entitlement to benefits and referral to other statutory bodies involved with retraining, special needs education for those of school and college age, rehabilitation, employment, social, leisure and recreational activities, and introduction to self-help groups.

1.6 Summary: This unit has examined who the ophthalmic patient is and the resources available for these clients outside the Nigerian context.

1.7 References/Further Readings/Web Resources

Bruce, I., McKennel, A. & Walker, E. (1991). Blind and Partially Sighted Adults in Britain. The Royal National Institute for the Blind Survey, HMSO, London.
Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell

1.8 Answers to Self-Assessment Exercise(s)

Answers to Self-Assessment Exercise
- Diabetes mellitus (Type 1 or Type 2), and Ankylosing spondylitis or arthritis

Answer to Self-Assessment Exercise 2
False.

Unit 2: The Ophthalmic Nurse

2.1 Introduction

It is becoming increasingly common for ophthalmic patients to be cared for in environments other than specialist ophthalmic units. Primary care settings are the focus of many aspects of ophthalmic care, for example in walk-in centres where people attend with a variety of ailments for advice, treatment or referral. In addition, street optometrists are expanding the range of conditions they diagnose and manage.

2.2 Learning Outcomes

By the end of this unit, the learner will be able to:

- Discuss the roles and duties of an ophthalmic nurse
- Identify the qualification for an ophthalmic nurse.

2.3 The Ophthalmic Nurse

The nurse with overall responsibility for the care of the ophthalmic patient should ideally hold a first degree and a specialist ophthalmic qualification. All must have gained applied knowledge and skills whilst practising clinically. Within the wider workforce planning agenda, other clinical roles are being developed such as assistant practitioners and surgical care practitioners.

Ophthalmic nurses will naturally be continuing to expand their practice to include, for example: nurse consent; pre-operative assessment and diagnosis and management of ocular emergencies (including telephone triage). As specialist practitioners, ophthalmic nurses will also care for and manage groups of patients linked to ophthalmic sub-specialities: stable glaucoma patients, or those involving oculoplastic procedures, cataracts, corneal conditions, uveitis or emergencies. With any of these expanded roles, the ophthalmic nurse must always be mindful of her professional accountability.

The ophthalmic nurse must naturally possess all the qualities required of a nurse working in any speciality or environment. Some characteristics, however, are more important to a nurse specialising in the diseases and conditions of the eye. The eye is very delicate and sensitive, and most of the patients the nurse will attend to will have varying degrees of anxiety about their eye and pain or discomfort in or around the eye. In order to allay any fears the patient may have about his eyes being touched, the ophthalmic nurse must be extremely gentle with her hands and in her manner. The nurse should be aware of her position and work on the patient's right-hand side when dealing with the right eye and vice versa with the left.

The eye is small, and there is not much room for manoeuvre around it when performing manual nursing procedures. The nurse therefore needs to be manually dexterous, and she also needs to have the best possible vision when performing nursing procedures. There is no place for vanity when dealing with the ophthalmic patient – wearing glasses for close work, should these be required, is essential.

As ophthalmic patients can be from any age group, the nurse needs to be familiar with the special requirements of all ages – those of the very young and the old in particular. However, it is recognised that specialist paediatric nurses should, as a matter of course,

care for children. The difficulty here is that there are very few paediatric nurses with an ophthalmic qualification.
The nurse must be thoughtful in her approach to the visually impaired person. She must use a variety of interpersonal skills to their best advantage, including: touching as appropriate to indicate presence or to show concern; introducing herself; indicating when she is leaving; and never shouting. There is a great temptation to assume that a person who is visually impaired is also hard of hearing.
The nurse must always bear in mind that there is an individual human being behind the eyes that are being treated, and should care for each patient as a whole, unique person.

2.4 Assessment of patients

Ophthalmic patients receive treatment as outpatients, day cases, and in primary care settings. If hospitalised, they have a tendency to spend a minimum of time actually in hospital. Today's ophthalmic nurse has a inadequate amount of time in which to get to know the patient and be able to assess his needs and therefore must employ clear, brief assessment skills in order to carry out an effective assessment. Many aspects of patient assessment are by necessity delegated to other carers in the team. For example, a clinical support worker may measure visual acuity, take blood or record an electrocardiogram (ECG), and a technician may perform biometry.
Patient assessment remains one of the most important interactions that nurses will have with their patients and, in order to do this thoroughly and efficiently, excellent communication skills are required. The ophthalmic nurse must therefore use verbal and non-verbal skills appropriately. Open-ended questions yield more information than closed questions. For example, asking a patient, 'Are you managing to put your drops in alright?' is likely to result in a simple yes or no reply, but had they been asked, 'How often do you miss putting in your drops?', they are in effect being given opportunity to admit to missing drops or having difficulty. An appropriate tone and pitch of voice should be employed. The ophthalmic nurse must be aware of the effects of eye contact, facial expression, posture, gestures and touch on the patients, remembering that non-verbal communication apart from touch may not always be immediately appropriate to the visually impaired. However, if the ophthalmic nurse does not utilise her non-verbal communication skills, it could affect her own attitude and behaviour, and the patient or the carer could in turn pick this up. It is also useful to integrate counselling skills such as the use of active listening, silence, and attention and paraphrasing, in order to gain additional understanding of the patient's needs. The ophthalmic nurse also needs to be very observant. The importance of clear and concise recordkeeping cannot be overemphasised.

2.4.1 Patient information and teaching

It is well recognised by nurses that giving information about procedures, for example, relieves anxiety and aids recovery. Not only do patients and carers need to know what is wrong with them and how they will be managed medically or surgically; the majority will also want to know why they are having that particular treatment. Patients and carers have ready access to Internet resources and frequently will have downloaded

information about their condition and treatment options. The ophthalmic nurse needs to be aware of this and should be in a position to advise the patient as to the accuracy and reasonableness of information obtained from these resources. Many hospitals and clinics place patient information on their own Web pages as well as such information being available on a range of electronic media. Having an understanding of the rationale behind treatment will aid compliance and will enable the patient to be actively involved in his own care. Patients and carers need information at all stages of management. Patients do benefit from effective pre-operative teaching programmes.

Care systems are based on efficient multidisciplinary team-working. Nurses alongside other allied health professionals, such as orthoptists and optometrists, also provide ophthalmic services and are considered key to the provision of quality services and the empowerment of the patient.

The ophthalmic nurse must, therefore, be in possession of sound knowledge in order to impart accurate information. She also needs time and the ability to use communication skills, mentioned above, appropriately. The nurse needs to assess how much information the patient needs, and in what depth, as well as whether to use lay or professional terminology. The ophthalmic nurse needs to be able to impart information to all age groups. As many of the patients are elderly, she needs a special understanding of the needs this group of individuals. Although the senses are often reduced due to the ageing process, this does not mean that the elderly cannot learn about their health needs. Visually impaired elderly people with a hearing loss are a challenge to the ophthalmic nurse, especially as loss of both of these senses may cause them some confusion.

2.4.2 Professional issues

Ophthalmic nurses must be research-aware and should be encouraged to become involved in clinical research studies and clinical assessment. Whilst there is an increasing body of ophthalmic nursing research, much of what ophthalmic nurses do is not research based.

Health professionals are being encouraged to reflect on their practice and the ophthalmic nurse is no exception. Reflection allows time for nurses to ponder on their practice and discover ways to improve their performance.

Reflection is encouraged as it goes some way to filling the theory/practice gap in nursing. Nurses have continued to expand their roles in response to the changing demands of the service, and are increasingly undertaking roles previously carried out by doctors. Some duties previously performed by ophthalmic nurses are now within the domain of assistant practitioners and clinical support workers. They too must have the required underpinning knowledge.

Ophthalmic nurses have a key role to play in health education and health promotion. This includes informing people of how to avoid accidents in the home or work setting and screening for diseases such as open-angle glaucoma.

Ophthalmic nurses have a prime responsibility for the quality of care they deliver, regardless of the setting. The ophthalmic nurse should use a quality framework to audit her practice and to make comparisons with practices outside her own unit/place of work.

Self-Assessment Exercises 1

Fill the space for question 1; Pick the correct option for question 2.

1. _____ is the most important interactions that nurses have with their patients.

2. One of the following measure allows time for nurses to ponder on their practice and discover ways to improve their performance.
a) Assessment
b) Reflection
c) Diagnosis
d) Evaluation
Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

2.4.3 The nurse in the outpatient department

The outpatient department is the portal into the hospital or unit for the majority of patients attending with eye conditions and may be the only department they visit. It is therefore important that the nurse working there should be a good advertisement for the whole hospital or unit. Standards exist to ensure that patients do not have to wait longer than 18 weeks from referral to commencement of treatment.
Outpatient departments are always busy and, whilst great progress has been made in ensuring shorter waits for appointments (including booked appointments), there seems to be no answer to the problem of waiting time in the clinic itself. A number of methods for alleviating the frustrations and boredom experienced due to the waiting are available to the nurse running the clinic. She can inform the patient approximately how long the wait will be and give an explanation for any delay, if possible. This may help avoid tempers becoming frayed. It is also useful to have a snack bar to which patients and relatives may be directed, where they can while away the time and prevent hypoglycaemic episodes in the diabetic patient. It is also important to advise patients about how the clinic works so that they can understand, for example, that a patient returning from a test or investigation is not jumping the queue but rather is completing his consultation.
Some outpatient departments have involved other allied health professionals in the management of certain clinical cases. Optometrist-led glaucoma services are one such example. Other initiatives involve patients being seen in primary care settings.
All patients visiting the outpatient department have their visual acuity recorded, this usually being the responsibility of the nurse. Other nursing procedures may include:

- Lacrimal sac washouts;
- Epilation of lashes;
- Taking conjunctival swabs;
- Removing sutures;
- Removing/inserting/cleaning contact lenses;
- Instilling drops/ointment;

- Removing/inserting ocular prostheses;
- Testing for dry eyes using tear strips;
- Applying eye pad and bandaging;
- Recording blood pressure, as hypertension can be associated with retinopathies and central artery and vein occlusions; the blood pressure will need to be recorded if the patient is to undergo surgery, and for general screening;
- Testing urine and/or blood glucose monitoring to ensure that the patient is not diabetic, as diabetes can cause various ophthalmic conditions, and for general screening;

Minor surgery and investigations will be carried out in the outpatient department, and the nurse will need to become familiar with the procedures and instruments as she may perform the investigations herself; the following are examples of operations and tests performed under local anaesthetic:

- Incision and curettage of chalazion;
- Lid surgery;
- Biopsy;
- Removal of lid tumours;
- Retropunctal cautery;
- Three-snip operation;
- Tonometry;
- Perimetry;
- Biometry.

The optometrist and prosthetist will normally have their clinics in the outpatient department, with the latter working as part of a team, together with the surgeon and the oculoplastic nurse practitioner. The high number of patients attending the outpatient department poses particular problems for the nurse, as she will be unable to learn about each patient's individual needs in detail. She must be aware of those patients who require particular attention in respect of their communication and mobility difficulties, which may result from visual impairment or from other physical impairments – or both.

2.4.4 The nurse in the accident and emergency department

The ophthalmic nurse working in the casualty department is in a similar environment and requires the same sorts of skills as the nurse working in the outpatient department. However, there has recently been a proliferation of nurse-led emergency eye services. The following conditions are considered to be ophthalmic emergencies and the patients will require immediate attention:

Sudden loss of vision due to:

- ❖ Central retinal artery occlusion;
- ❖ Central retinal vein occlusion;
- ❖ Giant cell arteritis;
- ❖ Retinal detachment – particularly if the macula is still attached.
- ❖ Primary acute glaucoma;
- ❖ Trauma, particularly penetrating or perforating injuries;
- ❖ Chemical burns;

- ❖ Orbital cellulitis.

Urgent cases that the nurse may have to deal with, but which are not classed as emergencies, include:

- Corneal ulcer;
- Vitreous haemorrhage;
- Acute dacryocystitis;
- Optic nerve disorders;
- Ocular tumours;
- Acute uveitis.

The nurse will need to inform the waiting patients of the approximate waiting time, and she may need to explain that some people require priority care and will be attended to as soon as they arrive in the department. Locally, in response to national targets of any patient waiting longer than 4 hours for treatment, many accident and emergency departments have escalation policies that 'kick in' if patient waiting times are getting too long.

2.4.5 The day case and ward nurse

Whilst the trend is towards day surgery for the majority of surgical cases, there will be some patients who require inpatient treatment, for example when there are co-existing medical problems or where the treatment centre is some distance from the patient's home.

Patients in the ophthalmic day case unit or ward will require pre- and postoperative care, as the majority are admitted for surgery, e.g. cataract extraction, squint surgery, repair of retinal detachment, drainage surgery for chronic glaucoma or following trauma. There may, however, be patients admitted for rest following trauma, for intensive treatment of a severe infection or for treatment of post-operative complications. The specific nursing care for each ophthalmic condition is detailed in the relevant chapters. However, a general note on nursing care is given here.

2.5 Pre-assessment

Patients having day case or inpatient surgery tend to be pre-assessed a few weeks prior to the operation. This assessment is carried out in order to establish the needs of the individual patient so that his short period in hospital can be planned, and also to give the necessary information regarding the surgery and to establish a post-operative care plan with the patient and carers.

Post-operative care will normally involve instillation of drops which, in the majority of cases, will be performed by the patient himself or his carer. Ideally, teaching drop instillation should be instituted at pre-assessment as there is little time for this during admission to hospital. Advising patients to purchase artificial tear drops and to practise at home following instruction is one way of overcoming the lack of time to teach this procedure and to observe the patient's performance.

The nurse has only limited time in which to assess the needs of the patients and must apply all her assessment skills appropriately. As well as giving the usual pre-operative

information to the patient, the nurse may carry out the following procedures and record results and act on findings:

- Testing distance visual acuity;
- Tonometry;
- Biometry;
- ECG;
- Focimetry;
- Slit lamp examination.

Information leaflets regarding the surgery and hospital stay should be given to the patient to support the verbal information and instructions that the nurse will give. These can be translated into languages other than English if necessary. This, together with answering any queries that the patient or carer may have, will help allay fears. Clinical governance requires that patients are actively involved in the production of patient information of any type.

2.5.1 Pre-operative care

In addition to routine pre-operative care for surgery being performed under either local or general anaesthesia, the nurse may be required to carry out the following procedures, depending on the personal preferences of the ophthalmic surgeon:

- Instilling mydriatic drops prior to cataract extraction or retinal detachment surgery as the pupil needs to be dilated for such surgery to be performed;
- Instilling miotic drops prior to trabeculectomy and keratoplasty;
- Instilling local anaesthetic drops such as G. oxybuprocaine 0.4%, if the operation is to be performed under a local anaesthetic.

These drops are usually administered against a prescription or patient group direction.

2.5.2 Post-operative care

In addition to the normal post-operative care required by any patient after surgery, the ophthalmic nurse will need to follow a routine such as that described here, although this will vary to some extent according to hospital practice.

2.5.2.1 Eye care

Post-operative eye care involves dressings, cleaning the eye or skin wound, inspection of the eye, instillation of drops and protection of the eye.

- Dressings – eye pads are used but also cartella shields, with or without a pad, may be in place following surgery. If indicated, as in some types of minor lid surgery, the pad is removed before the patient leaves the unit.
- Cleaning the eye or skin wound – the eye or skin will usually only be cleaned on the day following surgery; subsequent cleaning is usually performed once a day or more frequently if indicated. In the case of some oculoplastic procedures, the pad and bandage will remain untouched for between 5 and 7 days.

- Inspection of the eye and surrounding structures will be undertaken post-operatively.
- Instillation of drops – if prescribed, given accordingly; ointment, if prescribed, may be applied at night. It should be noted that ointment may be prescribed for structures other than the eye, for example suture lines on the lids.
- Protection of the eye – eye pads or cartella shields may be worn on the first post-operative day; cartella shields are usually worn only at night for 1 or 2 weeks following surgery.

Self-Assessment Exercises 2.

Pick the correct option for question 1; write true or False for question 2.

1.The following assessment are carried out on all clients that visiting the outpatient department of the ophthalmic clinic **except**_____

a) Visual acuity
b) Lacrimal sac washouts
c) Trabeculectomy
d) Epilation of lashes

2. Post-operative eye care involves instilling mydriatic drops. True/False

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

2.5.2.2 Discharge

All patients should be given instructions about care and follow-up:

- Eye drops or ointment – the patient or carer's ability to instil drops or apply ointment should be determined. Ideally, this process will have commenced at pre-assessment. Names of drops or ointment and times of instillation/application must be given verbally as well as written down.
- Cleaning the eye – if the eye is sticky in the mornings, it should be cleaned using cooled, boiled water in a clean receptacle and using cotton wool or gauze. Advise patients to avoid using dry cotton wool near the eye, as fibres can get into the eye.
- General instructions – patients should avoid stooping down too low in case they lose their balance. If appropriate, the patient should be advised to avoid anything causing increased exertion that will raise the intra-ocular pressure, such as lifting anything heavy. Patients should take care when they wash their hair to avoid getting soap or water into the eye as this would cause irritation that could result in rubbing behaviour. These restrictions should be heeded for 2 weeks initially, but are becoming increasingly less necessary with small incision surgery. Patients must take particular care not to knock or rub the eye, which could cause haemorrhage or cause the iris to prolapse through the wound.
- Outpatient appointment – ensure that the patient has an appointment, usually at 1 or 2 weeks following discharge. Transport may need to be arranged for the day.

- Primary care – the nurse may need to arrange for a community nurse to assist with drop instillation, or may need to organize for the social worker to assess the need for home help or meals on wheels for the patient, prior to discharge.
- Convalescence – not used often, but in some areas recuperation in a convalescent, residential or nursing home can be arranged for patients before they return to their own homes.
- Specialist procedures such as vitrectomy may require a patient to 'posture' in certain positions to ensure a satisfactory surgical outcome. To ensure that the patient complies with the posturing instructions, especially if they live alone, it may be necessary to involve other agencies such as those provided by social services and primary care.

It is helpful if all the above information and instructions are written down as well as given verbally, as there is often much detail to absorb in the excitement of going home.

2.6 Summary

This unit has considered the ophthalmic nurse and their basic function and initial assessment of the ophthalmic patients in the outpatient and various units of the ophthalmic clinic.

2.7 References/Further Readings/Web Resources

Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.
Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell.
Stein, H. A., Stein, R. M. & Freeman, M. I. (2013). The Ophthalmic Assistant A Text for Allied and Associated Ophthalmic Personnel. Elsevier Saunders.

2.8 Self-Assessment Exercise(s) within the content

Answers to Self-Assessment Exercises 1:

1. Patient assessment
2. c) Reflection

Answers to Self-Assessment Exercises 2:

1. c) Trabeculectomy
2. False

Unit 3: Ophthalmic Nursing Procedures

3.1 Introduction

This unit describes some ophthalmic procedures that are commonly performed by nurses in the course of ophthalmic care for clients presenting with an ophthalmic complaint: The principles of ophthalmic assessment will be examine to guide a nurse working in this unit and common charts used in the measurement of distance and near vision visual acuity.

3.2 Learning Outcomes

At the end of this unit, the learner will be able to:

- Highlight the general principles of ophthalmic procedures
- Describe the recording of visual acuity and various charts use for the test.

3.3 General principles

Ophthalmic procedures will differ to some point between hospitals or units. Those listed here can be used as guidelines but hospitals/unit policies must be conformed to. Patient consent to treatment is vital. It is also important to commemorate that all ophthalmic procedures should take into account the following:

- Communication;
- Patient education;
- Infection control;
- Health and safety;
- Maintenance of the patient's privacy and dignity.

Communication

Communication is an important aspect of patient care, and communication with someone who is visually impaired and who may have other disabilities such as hearing impairment and aphasia can be particularly challenging. Some health care professional may find it difficult and confusing when trying to communicate with someone with dual or numerous disabilities. The golden rule to remember is to communicate with the person and not the disability.

- Make sure that you are in the patient's field of vision when you approach them to avoid startling them.
- Communicate in a well-lit area and preferably in a quiet room.
- Take into account that a patient may have other hidden disabilities that you may not be aware of. For example, following a stroke, head injury or tumour, the patient may experience hemianopia or blindness and a loss of visual awareness as a result of damage to the optic nerve pathway to the brain.
- Do not shout or raise your voice. Remember the majority of patients are only visually impaired and have still retained all of their other faculties.
- Remember to speak slowly and clearly and to use non-verbal communication such as body language.
- Ensure that you say who you are when you begin to speak.
- Speak naturally and address the patient and not the carer.
- Where possible, find somewhere quite as noise can be a distraction for the patient.
- Before leaving the patient, always inform them of your intention. Otherwise the patient will be left talking to himself.

Education of the ophthalmic patient, including children

The majority of ophthalmic procedures carried out can seem extremely frightening away the patient, and the patients themselves can be sick about any procedures involving their eyes. It is therefore very important that, preceding any ophthalmic procedures, the patient is fully informed of the nature and process of the procedure. The explanation given must be clear and concise and must include all possible side-effects. Explanations must take into account the patient's learning style and intellectual ability, his physical and emotional state and any sensory deficits. When undertaking an ophthalmic procedure to a child, explanation must be given in a tactful and sensitive manner and must take into account the child's age, mental capability and other factors such as any pain or discomfort the child might be in. This requires the ophthalmic practitioner to be extra patient and to take into account the whole spectrum of the child's and parents' need, including the psychological and social aspects.
A successful outcome of the ophthalmic procedure will be guaranteed if cooperation is obtained from both parties and if any unnecessary trauma to the child and parents can be avoided.

Infection control

Infections in hospitals is a huge problem which continue to claim lives. A lot of measures has been put in place in many health care facilities to prevent nosocomial infections. Despite these measures, infection rates continue to climb, and antibiotic-resistant bacteria are now so well established that we may never get rid of them. Ophthalmic patients not only have to contend with the possibility of yielding to methicillin-resistant Staphylococcus aureus (MRSA) and Clostridium difficile (C. difficile), but also the possibility of extra-ocular and intra-ocular infection. Such infections can have a potentially devastating effect on the patients and their carers. For this reason, the importance of hand washing before and after each patient contact cannot be overemphasised.

Infection control also includes other measures such as employing single-use disposable items, correct decontamination and sterilisation of equipment; correct sharps and waste disposal; and observing standard precautions.

In order to further reduce the spread of infection, some hospitals and clinical practices have adopted the principles of Aseptic Non Touch Technique (ANTT) and incorporated it within ophthalmic procedures. The principle of ANTT aims to prevent micro-organisms on hands, equipment and surfaces from being introduced into any susceptible site via intravenous lines, urinary catheter or procedures such as cannulation, venepuncture, wound dressing and administration of intravenous or intra-cameral drugs.

Health and safety issues in ophthalmology

As with any area of medicine, health and safety within ophthalmology is of paramount importance. A system for improving standards of care and maintaining the health and safety of patients is addressed through clinical governance.

Clinical governance is a system that ensures that NHS organisations are accountable not only for meeting standards and improving clinical practice, but also have systems in place to safeguard practice. According to Kelly (2005), effective clinical governance within ophthalmology must include the following:

- The continuous improvement of patient services and care should be based on the best available evidence.
- The management of patient should be patient-centred and should take into account the individual needs of a patient.
- Patients should be kept fully informed of their treatment and the management of their ophthalmic condition.
- Patients should be treated with dignity and their privacy must be respected.
- An up-to-date workforce and clinical supervision should be in place.
- There should be a no-blame culture, with the opportunity to learn from errors.

Other health and safety–related issues to take into account must also include the following:

- Correct site surgery;
- Decontamination and sterilisation of equipment;
- Medical devices training;

- Infection control;
- Health and safety in the operating theatre.

Maintenance of patient's privacy and dignity

Privacy and dignity are two important aspects of care that all patients and carers are entitled to and are now seen as a high priority on the quality improvement agenda. A patient's privacy and dignity can be compromised through, for example, unnecessary interruptions such as telephone messages, entering consulting rooms without knocking, gaping curtains and theatre gowns and simply not closing the door of consultation rooms. Asking a patient's personal details or taking telephone messages in a crowded waiting room can also be problematic. It may not always be possible to take patients away to a noiseless and more private area, but privacy and dignity must be maintained in all consultations and treatments, and should be built into the care delivered to patients as well as in the environment in which care is being delivered.

Self-Assessment Exercise 1

1. Enumerate the five of the general principles guidelines that are observed in some hospitals/clinics when attending to ophthalmic clients.
2. What is Clinical governance?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

3.4 Recording visual acuity

Visual acuity is the measurement of acuteness of central vision only. An accurate assessment of visual acuity is one of the most important parts of any ophthalmic examination. Visual acuity is a test of the visual system from the occipital cortex to the cornea. Accurate visual acuity testing requires:

- Patient co-operation and comprehension of the test;
- Ability to recognise the forms displayed;
- Clear ocular media and correct focusing;
- Ability of the eyes to converge simultaneously;
- Good retinal function;
- Intact visual pathways and occipital cortex.

General considerations when performing visual acuity

- When performing visual acuity, a number of general considerations need to be taken into account, including adequate illumination, recording of contact lens wear and the use of methods to avoid patient 'cheating'. Good communication skills (including accurate instructions) and patience are particularly important with patients with any learning disabilities and language difficulties, and also with children.

- In order to assess accurately a patient's visual acuity (both distance and near), it is extremely important that the test type or reading material is correctly illuminated, i.e. if using a Snellen, that all the bulbs are in working order. When testing a patient's near vision, ensure that there is an adequate light source.
- It is also important to record if a patient uses contact lenses and if these were worn at time of testing.
- Since each eye is tested separately, it is a good idea to occlude the other eye with his outpatient card or occluder to avoid patient 'cheating' by looking through the gaps between his fingers. Similarly, it is a good idea to rotate the chart round for frequent attendees to the eye outpatient unit to minimise patients memorising the letters on the chart.

3.4.1 Common charts used in the measurement of distance visual acuity

The most common chart for measuring distance visual acuity in a literate adult is the Snellen chart.
Visual acuity (VA) tests the determining power of the eye. Distance vision is tested at 6 m, as rays of light from this distance are nearly parallel. If the patient wears glasses constantly, vision may be recorded with and without glasses, but this must be noted on the record. Each eye is tested and recorded separately, the other being covered with a card held by the examiner.

Snellen's test type

The standard test is the Snellen chart, consisting of rows of letters of decreasing size. Each row is numbered with the distance in metres at which each letter width subtends 1 minute of arc at the eye. Acuity is recorded as the reading distance (e.g. 6 metres) over the row number, of the smallest letter seen. If this is the 6 metre line, then VA is 6/6; if it is the 60 metre line then VA is 6/60.

Figure 1: Methods of assessing visual acuity: The Snellen chart

Self-Assessment Exercise 2

Provide the correct answer:

1. Accurate visual acuity testing requires all of the following except _____
   a) Patient co-operation
   b) Ability to read and write
   c) Ability to recognise the forms displayed
   d) Clear ocular media and correct focusing
2. _____ is tested by cards consisting of different sizes of ordinary printer's type, each card being numbered.

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

Sheridan Gardner test chart

The Sheridan Gardner test chart can be used for children and patients who are illiterate. This test type has a single reversible letter on each line. For example, A, V, N. The child holds the card with these letters printed on and is asked to point to the letter on his card which corresponds to the letter on the test type. This test can also be used for very young children as they do not have to name a letter.

Kay picture chart

The Kay picture chart is again used with patients who are illiterate or with children. Instead of letters, the book contains pictures, which are also of varying sizes. The patient is asked what the picture represents. In order to avoid

Using the pinhole in the measurement of visual acuity

Occasionally, a patient's visual acuity may be below average, which could be a result of a refractive error not corrected by glasses, or due to the patient wearing an old pair of prescription glasses. One effective, but very simple, way to see if distance visual acuity can be improved through spectacles or a change of prescription is a pinhole. A pinhole disc only allows central rays of light to fall onto the macula and does not need to be refracted by the cornea or lens. A 'pinhole disc' is used if the VA is less than 6/6 or 6/9, which may improve VA. If considerable increase in vision is obtained, it may usually be assumed that there is no gross abnormality, but a rather a refractive error.

Tumbling E chart

The tumbling E chart again is mainly used for patients who are illiterate. In the chart, the Es face in different directions. The patient is asked to hold a wooden E in his hand and to turn it the same way as the one the examiner is pointing to on the test chart.
It is important to remember to identify in the patient's notes which chart system has been used to test the patient's visual acuity; for example, if the
Kay picture chart is used, this must be indicated in the notes.

Near vision

Near vision is tested by cards consisting of different sizes of ordinary printer's type, each card being numbered. The eyes are tested and recorded separately and, if the patient uses reading glasses, these should be worn during the test.
The card is held at a comfortable distance (approximately 25 cm) and should be well illuminated by a light from behind the patient's shoulder. The near vision is recorded as the card number of the smallest type size he can most easily read.

3.4.1.2 Utilising information gained from visual acuity testing

The measurement of accurate visual acuity is an important and vital part of any Ophthalmological examination. It not only provides the healthcare professional with information on a patient's visual system, but also allows us to gain a realistic insight into a patient's ability to function as a whole. The information gained from measuring a patient's visual acuity allows us to:

- Provide a baseline for monitoring of treatment including medical, laser and surgical.
- Monitor the progression or otherwise of the disease.
- Assess a patient's ability to cope and also enable us to provide the most appropriate form of support.
- Provide a measurement tool to assess a patient's vulnerability to trips and falls and to take appropriate measure for their prevention.
- Plan an appropriate form of communication with the patient.
- Prioritise a patient's needs and provide appropriate intervention where necessary, depending on the wishes of a patient – such as social services or district nurses.

3.5 Summary: This unit focused on the general principles of ophthalmic procedures and various chat use in ophthalmic clinic to assess ophthalmic clients on first contact in the clinic. The unit also highlighted some of the charts that can be used for children and illiterates clients.

3.6 Tutor Marked Assignment

Describe the six (6) muscles of the eye stating how it rotates

3.7 References/Further Readings/Web Resources

Kelly S. (2005) Patient Safety in Ophthalmology. Royal College of Ophthalmologists. http://www.rcophth.ac.uk
Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell.

3.8 Answers to Self-Assessment Exercise(s)

Answers to Self-Assessment Exercises 1

- Communication;
- Patient education;
- Infection control;
- Health and safety;
- Maintenance of the patient's privacy and dignity.

2. Clinical governance is a system that ensures that NHS organisations are accountable not only for meeting standards and improving clinical practice, but also have systems in place to safeguard practice.

Answers to Self-Assessment Exercise 2
1. b) Ability to read and write
2. Near vision

UNIT 4: DIAGNOSTIC ASSESSMENT FOR CONDITION OF THE EYE
UNIT 4: Diagnostic Assessment for Condition of the Eye

UNIT 4: Diagnostic Assessment for Condition of the Eye

4.1 Introduction

The assessment of the visual system may be as simple as determining patient's visual acuity or as complex as collected complete subjective and objective data pertinent to the visual system. To do an appropriate ophthalmic evaluation the nurse must determine which part of the data collection are important for each patient.

4.2 Learning Outcomes

Demonstrate knowledge and understanding of diagnostic tests for assessment of vision and evaluation of visual disabilities.

4.3 Subjective data

4.3.1 Important health information

Past health history:

Information about the patients past health history should include both ocular and nonocular history. The nurse should ask the patient specifically about systemic diseases such as diabetes, hypertension, cancer, rheumatoid arthritis, syphilis and other sexually transmitted disease (STDs), acquired immunodeficiency syndrome (AIDS), muscular dystrophy, etc. because many of these diseases have ocular manifestations. It is particularly important to determine if the patient has any history of cardiac or pulmonary disease because beta adrenergic blocking agents are often use to treat glaucoma. These medications can also slow heart rate, disease blood pressure and exacerbate asthma or emphysema.

A history of tests for visual acuity should be obtained including the date of the last examination and change in glasses or contact lenses. The nurse should specifically ask about a history of cataracts, retinal detachment or glaucoma. Any trauma to the eye, treatment should be noted.

Medication

If the patient takes medication, the nurse should obtain a complete list including over the counter (OTC) medicines, eye drops and herbal or natural supplements. These drugs have ocular effects which should not be overlooked. The use of antihistamines or decongestants should be noted because they can cause ocular dryness.

Surgery or other treatments

Surgical procedures related to the eye or brain should be noted. Brain surgery and subsequent swelling can cause pressure on the optic nerve or tract, resulting in visual alternations. Any laser procedures to the eye should be documented. The effect of eye

surgery or laser procedure or treatment on visual acuity is important information for the nurse to obtain.

4.4 Functional health patterns

The ophthalmic patient may seek health care for specific problem or for regular ophthalmic care. When the patient needs routine ophthalmic care, the nurse will focus the assessment of functional patterns on issues related to health promotion. When the patient has a recognized problem, the nurse will direct the assessment to identify those issues related to patient's specific problem.
Ocular problem do not always affect the patient's visual acuity. For example patient with blepharitis or diabetes retinopathy may not have any visual deficit. The nurse should be aware that many conditions can cause vision loss. The focus of functional health pattern assessment depends on the presence or absence of vision loss and whether the loss is permanent or temporary.

Health perception – health management pattern

The patient's age is pertinent as considering cataracts macular problems, glaucoma and other ophthalmic conditions, men are likely than women to have colour blindness, older individuals are at higher risk of damage to the optic nerve from glaucoma.
The ophthalmic patient is often seeking routine eye care or changes in prescription of eye wear. However, there can be some underlying concern that the patient may not mention or even recognize. The nurse should obtain this information by asking "why are you here today"?
The patient's visual health can affect activities at home or at work, it is important to know how the patient perceives the current health problem. The nurse should also assess the patient's ability to accomplish all necessary self-care, especially any eye care related to the patient's ophthalmic problem.
The patient may not recognize the important of eye safety practices such as wearing protective eyewear during potentially hazardous activities or avoiding noxious fumes and other eye irritants. Information about the use of sunglasses in bright light should be obtained. Prolong exposure to ultraviolet light can affect the retina. Night driving habits and any problems encountered should be noted.
Obtain information about allergies. Allergies often cause eye symptoms such as itching, burning, watering, drainage and blurred vision.

Nutritional metabolic pattern

The patient's intake of antioxidant vitamins and trace minerals can be important to ocular health. Adequate intake of vitamin C and E may be beneficial in preventing or delaying retinal damage and zinc deficiency is linked to erythematous scale in periorbital area.

Elimination pattern

Straining to defecate (Valsalva's maneuover) can raise the intraocular pressure. Although there is some evidence that elevating the intraocular pressure by normal activities is not detrimental to the surgical incision made during eye surgery, many surgeons do not want the patient straining. The nurse should assess the patient's usual pattern of elimination and determine whether there is the potential for constipation in the patient who has had ophthalmic surgical procedures.

Activity-exercise pattern

The patient's usual level of activity or exercise may be affected by reduced vision by symptoms accompanying an ocular problem or by activity restrictions following a surgical procedure. For example a patient with intraocular bleeding may be on bed rest or have severely restricted activity.

Sleep-rest pattern

In the otherwise healthy person, lack of sleep may cause ocular irritation especially in the patient who ears contact lenses. Normal leep patterns may be disrupted in the patient with painful eye problems such as corneal abrasions. The patient with alkali burns of the eye requires continuous irrigation of the ocular surface until the PH of the conjunctival sac returns to normal levels. Normal sleep will be disrupted during this time.

Cognitive-perceptual pattern

The entire assessment of the ophthalmic patient focuses on the sense of sight, but it is important not to overlook other cognitive or perceptual problems. For example the functional cubility of a patient with visual deficit will be further compromised if the patient also has hearing problems. The patient who cannot see the read has increased difficulty in following post-operative instruction.
Eye pain is always an important symptoms to assess corneal abrasions, iritis and acute glaucoma manifest with pain and are serious eye problems. Infections and foreign bodies can also cause less severe eye discomfort.

Self-perception-self-concept pattern

The loss of independence that follow a partial or complete loss of vision even if the condition is temporary can have devastating effects on the patient's self-concept. The nurse should carefully evaluate the potential effect of vision loss on the patient's self-image for instance, daubing glare from cataract may prevent night-time driving or even limit daytime draining, resulting in a diminished self-image. The patient other disfiguring ophthalmic condition may be embarrassed by his or her appearance and suffer from a poor self-image.

Role-relationship pattern

The patient's ability to maintain the necessary or desired roles and responsibility in the work, home and social environment can be negatively affected by ocular problems. E.g, macular degenerate to function it work. Many occupation place workers in conditions in which eye injury may occur. E.g., factory workers may be at risk from flying metal debris. The patient with diabetes may not be able to see well enough to self-administer insulin. The nurse should sensitively inquire if the patient's preferred roles and responsibilities have been affected by the ocular problem.

Sexuality-reproductive pattern

The inactivity that may be associated with low vision, blindness and certain eye problems and surgeries can negatively affect a patient's sexuality. The patent with severe vision loss may develop such poor self-image that the ability to be sexually intimate is lost. The nurse can assure the patient that low vision or blindness does not affect a person's ability to be sexually expressive.
If a patient with low vision or blindness has a family, assistance with child-rearing task may be necessary. The nurse should determine the need and availability of help if this situation is present.

Coping-stress tolerant pattern

The patient with temporary or permanent visual problems will experience emotional stress. The nurses should assess the patient's copying level, copying mechanisms, and availability of social and personal support systems. The patient with permanent visual loss experiences the visual stages of grief after the loss. The nurse should assess the potential need for psychosocial counselling and eventual vocational rehabilitation.

Value-belief pattern

The nurse must be sensitive to the individual values and spiritual beliefs of each patient because the patient makes decisions regarding ophthalmic care based on those values and beliefs. It can be difficult to understand why a patient refuses treatment that has potential benefit or wants treatment that may have limited potential benefit. The nurse should assess the patient's value-belief pattern that serves as the basis for making those decisions.

Self-Assessment Exercise 1

Write True/False against the following statement

1. The focus of functional health pattern assessment depends on the presence or absence of vision loss and whether the loss is permanent or temporary.
2. Valsalva's maneuover is a situation when patient with temporary or permanent visual problems will experience emotional stress.

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

4.5 Objective data

4.5.1 Physical examination

Physical examination of the visual system includes inspecting the ocular structures and determining the status of their respective functions physiologic functional assessment includes determining the patient's visual acuity, determining the patient's ability to judge closeness and distance, assessing extra ocular muscle function and evaluating the visual fields, observing pupil function, and measuring the intraocular pressure. Assessment of ocular structures should include examining the ocular adnexa, external eye and internal structures. Some structures, such as the retina and blood vessels, must be visualized with the aid of various ophthalmic observation equipment such as bio microscope and the ophthalmoscope.

Assessment of the visual system may include all the following components or it may be as brief as measuring the patient's visual acuity. The nurse will assess what the appropriate and necessary for the specific patient.

4.5.2 Initial observation

The initial observation of the patient can provide information that will help the nurse focus the assessment. When first encountering the patient, the nurse may observe that the patient is dressed in clothing with usual colour combination. This may indicate a colour-vision deficit. The nurse may also note an unusual head position. The patient with diplopia may hold the head in a skewed position in an attempt to see a single image. The patient with corneal abrasion or photophobia will cover the eyes with the hands to try to block out room light. The nurse can make a crude estimate of depth perception by extending a hand for the patient to shake.

During the initial observation, the nurse should also observe the overall facial and ophthalmic appearance of the patient. The eyes should be symmetric and normally placed on the face. The globes should not have a bulging or sunken appearance.

Self-Assessment Exercise 2

1. State the difference between subjective and objective data in ophthalmic assessment.
2. What is the purpose of conducting pupil function test?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

4.6 Assessment techniques: Visual system technique

Visual acuity testing

Description: Most health care providers are familiar with the standard Snellen chart. This chart is composed of a series of progressively smaller rows of letters and is used to test distance vision. The fraction 20/20 is considered the standard of normal vision. Most people can see the letters on the line designated as 20/20 from a distance of 20

feet. A person whose vision is 20/200 can see an object from 20 feet away that a person whose vision is 20/20 can see from 200 feet away.
The patient is positioned at the proscribed distance, usually 20 feet, from the chart and is asked to read the smallest line that he or she can see. The patient should wear distance correction (eyeglasses or contact lenses) if required, and each eye should be tested separately. The right eye is commonly tested first and then the left. If the patient is unable to read the 20/20 line, he or she is given a pinhole occlude and asked to read again using the eye in question.
Purpose: To determine patient's distance and near visual acuity

Extra ocular muscle function testing

Description: Examiner has [patient follow a light source or other fixation object through a complete field of gaze =, in the cover-uncover test, examiner covers patient's eye and then uncovers it to see if eye has deviated under the cover.
Purpose: To determine if patient's extra ocular muscles are functioning in a normal manner, with no underaction or overaction.

Confrontation visual field test
Description: Patient faces examiner, covers one eye, fixates on examiner's face, and counts number of fingers that the examiner brings into patient's field of vision
Purpose: To determine if patient has a full field of vision, without obvious scotomas.
Pupil function testing
Description: Examiner pupillary response, each pupil is examined independently, examiner also checks for consensual and accommodative response.
Purpose: To determine if patient has normal pupillary response.

Tonometry
Description: Applanation tonometer is a gently touched to the anesthetized corneal surface examiner look through ocular of slit-lamp microscope, adjusts pressure dial until mires are aligned and notes intraocular pressure reading. The principle involved is that a soft eye is dented more easily than a hard eye. Pressure is measured in millimetres of mercury (mm Hg). High readings indicate high pressure; low readings, low pressure. The three most common types of tonometer are indentation, applanation, and noncontact. The procedure is non-invasive and is usually painless. A topical anaesthetic eye drop is instilled in the lower conjunctival sac, and the tonometer is then used to measure the IOP.
Purpose: Tonometry measures IOP (normal pressure is 10-21 mmHg) by determining the amount of force necessary to indent or flatten (applanate) a small anterior area of the globe of the eye.
Slit-lamp microscopy
Description: Patient is seated with chin placed in chin rest, slit beam illuminates ocular structures, examiner looks through magnifying ocular assess various structures.
Purpose: To provide magnified view of the conjunctiva, sclera, cornea, anterior chamber, iris, lens and vitreous.

Colour vision testing
Description: Patient identifies numbers or paths formed by pattern of dots in series of colour plates
Purpose: To determine patient's ability to distinguish colour.

Self-Assessment Exercise 2

1. What do you understand by subjective data?
2. What is the purpose of subjective data?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

4.7 Summary

This unit highlighted the important of complete assessment of the eye ranging from important health information: Past health history, medication history, surgeries, other health history and assessment using eleven health functional pattern as advocated by Marjorie Gordon and also various assessment techniques that can be conducted by nurses.

4.8 References/Further Readings/Web Resources:

Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.
Shaw, M. E & Lee, A. (2010) Ophthalmic Nursing Fourth Edition. Wiley-Blackwell.

4.9 Answers to Self-Assessment Exercise(s) within the content

Self-Assessment Exercise 1

1. True
2. False

Self-Assessment Exercise 2

1. Subjective data are information from the client's point of view ("symptoms"), including feelings, perceptions, and concerns obtained through interviews. Objective data are observable and measurable data ("signs") obtained through observation, physical examination, and laboratory and diagnostic testing.
2. To determine if patient has normal pupillary response

End of the Module 1 Question

Using Marjorie Gordon's 11 functional health patterns, discuss the nursing assessment of patients with eye disease.

MODULE 2: INTRODUCTION AND BASICS ANATOMY AND PHYSIOLOGY OF THE EYE

Module Structure

Unit 5: Anatomy and Physiology of the Eye

Unit Structure

5.1 Introduction

The eye is one of the sensory organ in the body responsible for gathering stimuli to assist people in communicating with the world around them. Nursing need an understanding of the structure and function of the eye and of the relationship of the eye to the body, when caring for patients with ophthalmic disorders. In addition, the assessment of the visual function is an important component of the physical assessment process because other conditions affect the eye and vision. To this end, no one is expected to be careless in the care of his/her eyes. A proper understanding of the anatomy and physiology of this delicate structure which is the gateway to living is required by you.
This unit will present the anatomical structures of the eye as well as its physiological status. It is hoped that as a nurse, you will find it very instructive with a view to equip yourself with skills to provide eye care at all level.

5.2 Learning Outcomes

At the end of this unit, the learner will be able to:

- Draw and describe the structures of the human eye
- State the functions of the extra ocular eye muscles
- Explain the physiology of sight

5.3 Structure of the Eye

The human eye is a significant human sense organ. It is situated in the orbital cavity and supplied by the optic nerve 2nd cranial nerve). It allows humans conscious light perception, vision, which includes colour differentiation and the perception of depth. The human eye has a 200° viewing angle and can see 10 million colours. The human eye is roughly spherical in shape and about 2.5 cm in diameter. The space between the

eye and the orbital cavity is occupied by adipose tissue. The bony walls of the orbit and the fat help to protect the eye from injury. It is bounded by three distinct layers of tissue. The outer layer, the Sclera/sclerotic coat, is extremely tough. It is white in colour (the “white" of the eye) except in the front. Here it forms the transparent cornea, which admits light into the interior of the eye and bends the light rays so that they can be brought to a focus. The surface of the cornea is kept moist and dust-free by the secretion from the tear glands.

Structurally the two eyes are separate but, unlike the ear, some of their activities are coordinated so that they function as a pair. It is possible to see with only one eye (monocular vision), but three dimensional vision is impaired when only one eye is used, especially in relation to the judgement of speed and distance.

There are three layers of tissue in the walls of the eye:

- The outer fibrous layer: sclera and cornea
- The middle vascular layer or uveal tract: consisting of the choroid, ciliary body and iris
- The inner nervous tissue layer: retina.

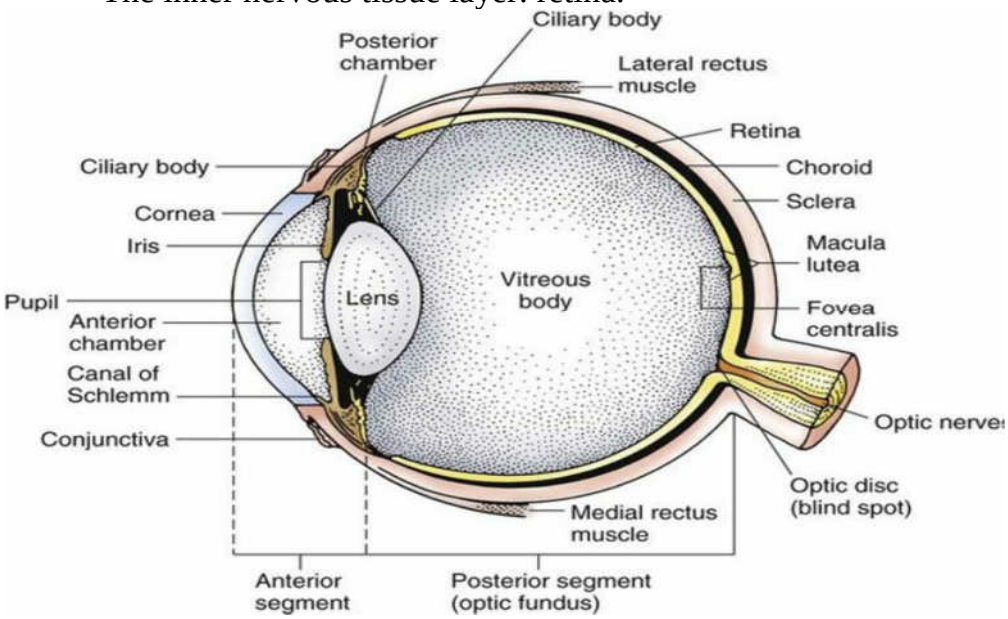

Figure 2: Structure of the Human Eye.

Sclera and cornea

The sclera, or white of the eye, forms the outermost layer of the posterior and lateral aspects of the eyeball and is continuous anteriorly with the transparent cornea. It consists of a firm fibrous membrane that maintains the shape of the eye and gives attachment to the extrinsic muscles of the eye.

Cornea - The cornea is a strong clear bulge located at the front of the eye (where it replaces the sclera - that forms the outside surface of the rest of the eye). The front surface of the adult cornea has a radius of approximately 8mm. The cornea contributes to the image-forming process by refracting light entering the eye. The corneal endothelium has two very significant functions: it controls the movement of fluids and solutes through the cornea and it pumps excessive fluid out of the cornea to maintain its clarity. Anteriorly the sclera continues as a clear transparent epithelial membrane, the

cornea. Light rays pass through the cornea to reach the retina. The cornea is convex anteriorly and is involved in refracting (bending) light rays to focus them on the retina.

Choroid

The choroid lines the posterior five-sixths of the inner surface of the sclera. It is very rich in blood vessels and is deep chocolate brown in colour. Light enters the eye through the pupil, stimulates the sensory receptors in the retina and is then absorbed by the choroid.

Papilla

The papilla is also known as the "blind spot" and is located at the position from which the optic nerve leaves the retina

Pupil

The pupil is the aperture through which light - and hence the images we "see" and "perceive" - enters the eye. This is formed by the iris. As the size of the iris increases (or decreases) the size of the pupil decreases (or increases) correspondingly. An opening, the pupil, is present in the centre of the iris. The size of this opening is variable and under automatic control. In dim light (or times of danger) the pupil enlarges, letting more light into the eye. In bright light, the pupil closes down. This not only protects the interior of the eye from excessive illumination, but improves its image-forming ability and depth of field. Photographic enthusiasts, too, make a practice of "stopping down" the iris diaphragm of their cameras to the minimum permitted by the amount of light available in order to get the sharpest possible pictures.

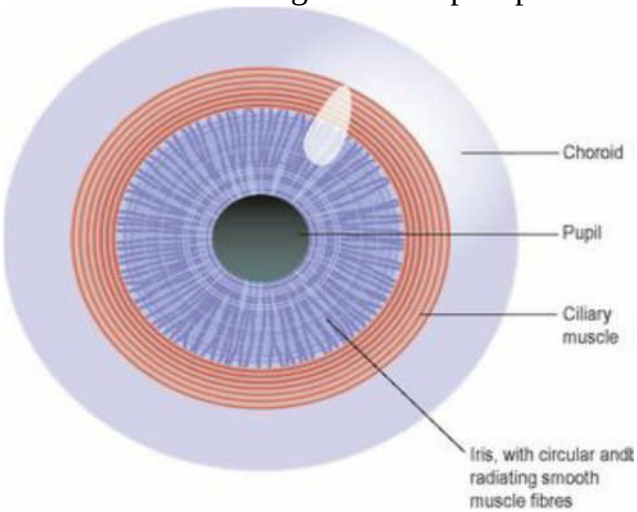

Figure 3: Choroid, ciliary body and iris.

Ciliary body

The ciliary body is the anterior continuation of the choroid consisting of ciliary muscle (smooth muscle fibres) and secretory epithelial cells. As many of the smooth muscle fibres are circular, the ciliary muscle acts like a sphincter. The lens is attached to the

ciliary body by radiating suspensory ligaments, like the spokes of a wheel. Contraction and relaxation of the ciliary muscle fibres, which are attached to these ligaments, control the shape of the lens. The epithelial cells secrete aqueous fluid into the anterior segment of the eye, i.e. the space between the lens and the cornea (anterior and posterior chambers) and focus the lens. The ciliary body is supplied by parasympathetic branches of the oculomotor nerve (3rd cranial nerve). Stimulation causes contraction of the ciliary muscle and accommodation of the eye.

Iris

The iris is the visible coloured part of the eye and extends anteriorly from the ciliary body, lying behind the cornea and in front of the lens. It divides the anterior segment of the eye into anterior and posterior chambers which contain aqueous fluid secreted by the ciliary body. It is a circular body composed of pigment cells and two layers of smooth muscle fibres, one circular and the other radiating. In the centre is an aperture called the pupil.
The iris is supplied by parasympathetic and sympathetic nerves. Parasympathetic stimulation constricts the pupil and sympathetic stimulation dilates it.
The colour of the iris is genetically determined and depends on the number of pigment cells present. Albinos have no pigment cells and people with blue eyes have fewer than those with brown eyes.

Lens

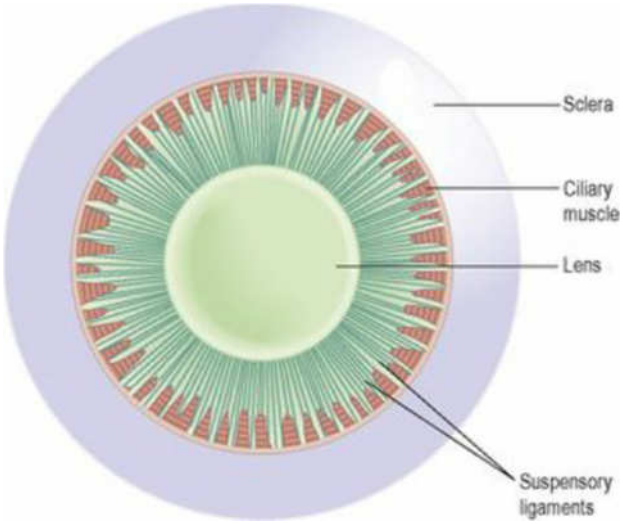

Figure 4: The lens and suspensory ligaments viewed from the front. The iris has been removed.

The lens is a highly elastic circular biconvex body, lying immediately behind the pupil. It consists of fibres enclosed within a capsule and it is suspended from the ciliary body by the suspensory ligament.
Its thickness is controlled by the ciliary muscle through the suspensory ligament. When the ciliary muscle contracts, it moves forward, releasing its pull on the lens, increasing its thickness. The nearer is the object being viewed, the thicker the lens becomes to allow focusing.

The lens bends (refracts) light rays reflected by objects in front of the eye. It is the only structure in the eye that can vary its refractory power, which is achieved by changing its thickness.

Retina

The retina is the innermost layer of the wall of the eye. It is an extremely delicate structure and is well adapted for stimulation by light rays. It is composed of several layers of nerve cell bodies and their axons, lying on a pigmented layer of epithelial cells which attach it to the choroid. The light sensitive layer consists of sensory receptor cells, rods and cones, which contain photosensitive pigments that convert light rays into nerve impulses.

Broadly retina consists of two primary layers: an inner neurosensory retina and retinal pigment epithelium (RPE). Sensory retina develops from the inner layer of the neuroectoderm, whereas RPE is derived from the outer layer of the neuroectoderm.

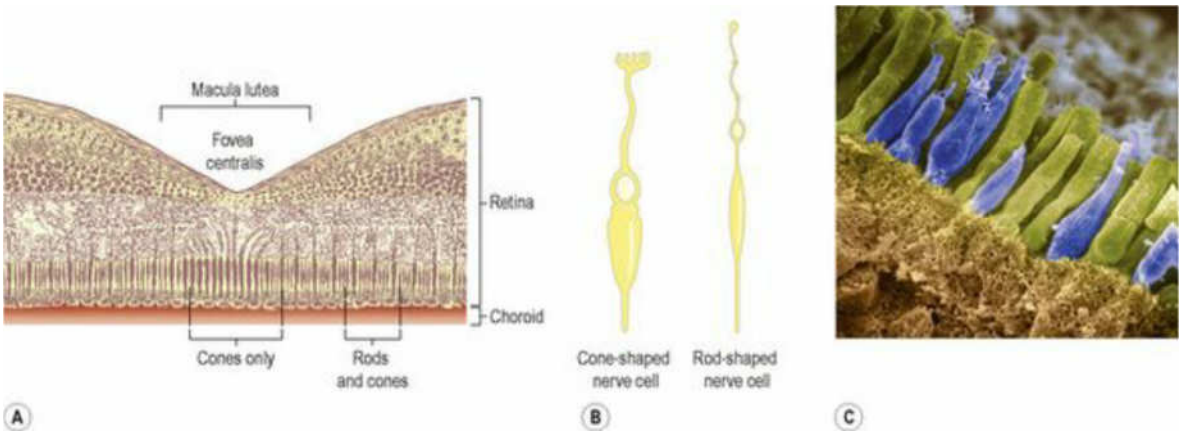

Figure 5: The retina. (A) Magnified section. (B) Light-sensitive nerve cells: rods and cones. C. Coloured scanning electron micrograph of rods (green) and cones (blue).

The retina lines about three-quarters of the eyeball and is thickest at the back. It thins out anteriorly to end just behind the ciliary body. Near the centre of the posterior part is the macula lutea, or yellow spot. In the centre of the yellow spot is a little depression called the fovea centralis, consisting of only cones. Towards the anterior part of the retina there are fewer cones than rods. Cone cells, or cones, are photoreceptor cells in the retinas of vertebrate eyes including the human eye. They respond differently to light of different wavelengths, and the combination of their responses is responsible for color vision.

About 0.5 cm to the nasal side of the macula lutea all the nerve fibres of the retina converge to form the optic nerve. The small area of retina where the optic nerve leaves the eye is the optic disc or blind spot. It has no light-sensitive cells.

Self-Assessment Exercise 1

1. What are the cornea's two main functions?
2. Name the two main layers of the retina and where they originate from.
3. What are the main functions of the ciliary body?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

5.4 Blood supply to the eye

❖ The ophthalmic artery and its branches supply the blood to the eye. Drainage is via the ophthalmic vein and its branches:
- The central retinal artery and vein supply and drain the retina.
- The short posterior ciliary artery and choroidal vein supply and drain the choroid.
- The long posterior ciliary artery supplies the ciliary body.
- The anterior ciliary artery supplies the:
- Ciliary body;
- Conjunctiva;
- Corneal limbus.

❖ The arterial circle of the iris, supplying blood to the iris, is formed from the:
- Long posterior ciliary artery;
- Anterior ciliary artery.

❖ The anterior ciliary vein drains the:
- Ciliary body;
- Iris;
- Conjunctiva;
- Corneal limbus.

❖ The conjunctival artery and vein supply and drain the conjunctiva.

❖ The superior and inferior medial palpebral artery and vein supply and drain the:
- Conjunctiva;
- Eyelids;
- Lacrimal sac.

❖ The episcleral artery and vein supply and drain the sclera.

❖ The lacrimal artery and vein supply and drain the:
- Lacrimal gland
- Eyelids.

❖ The supra-orbital artery and vein supply and drain the upper eyelids.

❖ The muscular artery and vein supply and drain the extra-ocular muscles.

❖ The nasal artery and vein supply and drain the lacrimal sac.

❖ The frontal artery and vein supply and drain the forehead.

❖ The four vortex veins drain the ciliary body, iris and choroid leaving the globe at its equator to drain into the ophthalmic vein.

5.5 Interior of the eye

The anterior segment of the eye, i.e. the space between the cornea and the lens, is incompletely divided into anterior and posterior chambers by the iris. Both chambers contain a clear aqueous fluid secreted into the posterior chamber by ciliary glands. It circulates in front of the lens, through the pupil into the anterior chamber and returns to the venous circulation through the scleral venous sinus (canal of Schlemm) in the angle between the iris and cornea. There is continuous production and drainage but the intraocular pressure remains fairly constant between 1.3 and 2.6 kPa (10 to 20 mmHg). An increase in this pressure causes glaucoma. Aqueous fluid supplies nutrients and

removes wastes from the transparent structures in the front of the eye that have no blood supply, i.e. the cornea, lens and lens capsule.
Behind the lens and filling the posterior segment (cavity) of the eyeball is the vitreous body.
This is a soft, colourless, transparent, jelly-like substance composed of 99% water, some salts and mucoprotein. It maintains sufficient intraocular pressure to support the retina against the choroid and prevent the walls of the eyeball from collapsing.
The eye keeps its shape because of the intraocular pressure exerted by the vitreous body and the aqueous fluid. It remains fairly constant throughout life.

5.6 Optic nerves (second cranial nerves)
The fibres of the optic nerve originate in the retina and they converge to form the optic nerve about 0.5 cm to the nasal side of the macula lutea. The nerve pierces the choroid and sclera to pass backwards and medially through the orbital cavity. It then passes through the optic foramen of the sphenoid bone, backwards and medially to meet the nerve from the other eye at the optic chiasma.

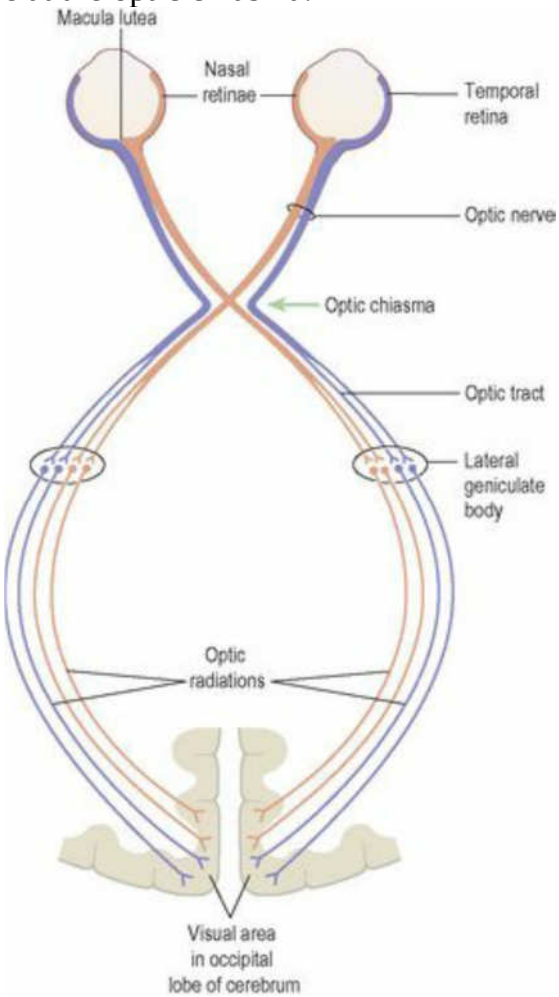

Figure 6: The optic nerves and their pathways
Optic chiasma
This is situated immediately in front of and above the pituitary gland, which is in the hypophyseal fossa of the sphenoid bone. In the optic chiasma the nerve fibres of the optic nerve from the nasal side of each retina cross over to the opposite side. The fibres

from the temporal side do not cross but continue backwards on the same side. This crossing over provides both cerebral hemispheres with sensory input from each eye.

Optic tracts

These are the pathways of the optic nerves, posterior to the optic chiasma (Fig. 8.13). Each tract consists of the nasal fibres from the retina of one eye and the temporal fibres from the retina of the other. The optic tracts pass backwards to synapse with nerve cells of the lateral geniculate bodies of the thalamus. From there the nerve fibres proceed backwards and medially as the optic radiations to terminate in the visual area of the cerebral cortex in the occipital lobes of the cerebrum. Other neurones originating in the lateral geniculate bodies transmit impulses from the eyes to the cerebellum where, together with impulses from the semi-circular canals of the ears and from the skeletal muscles and joints, they contribute to the maintenance of posture and balance.

5.7 Summary

A brief sketch of the anatomy of the eye and its surrounding structures has been presented. Each of these structures, when diseased, can give rise to problems, depending on its anatomic location and function. Because many diagnoses made in ophthalmology are formulated from anatomic terminology, familiarity with these structures is essential before any understanding of patients' problems can be realized. The following are the high points of our discussion in this unit: the anatomy and physiology of the human eye, the structures of the human eye, the physiology of the human eye, blood supply to the eyes and nerve innervation.

5.8 References/Further Readings/Web Sources

Scanlon, V. V & Sanders, T. (2007). Essentials of anatomy and physiology (5th edition). Sanders

Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell

Smelter, S. C & Bare, B. G. (2014). Brunner & Suddarth's Textbook of Medical-Surgical Nursing (10th edition). Lippincott Williams.

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Waugh, A. & Grant, A. (2010). Ross and Wilson Anatomy and physiology in Health and Illness. (11th Edition). Churchill Livingstone.

5.8 Answers to Self-Assessment Exercise(s)

Self-Assessment Exercises 1:

1. What are the cornea's two main functions?

The corneal endothelium has two very significant functions:

i. It controls the movement of fluids and solutes through the cornea
ii. It pumps excessive fluid out of the cornea to maintain its clarity

2. Broadly retina consists of two primary layers:

i. An inner neurosensory retina
ii. Retinal pigment epithelium (RPE).

Sensory retina develops from the inner layer of the neuroectoderm, whereas RPE is derived from the outer layer of the neuroectoderm

3. To focus the lens and secrete aqueous humour

Unit 6: The Muscles of the human eye

Unit Structure

Unit 6 : The Muscles of the human eye

6.1 Introduction

The muscles of the eye are very significance for fact that, they need to be coordinated for vision to be stereoscopic. It is necessary to note that, normal functioning means that both the eyes look in the same direction at the same time. If on assessment, the contrary is observed, it will be a guide to diagnosis and subsequent treatment.

6.2 Learning Outcomes

At the end of this unit, learners should be able to:

- State the functions of the extra ocular eye muscles
- Identify the muscles and nerves supplying all them.
- Explain the normal eye motion

6.3 The Muscles of the human eye

Proper functioning of the eye requires six muscles that control movement. They work together to offer a wide field of vision, allowing for up, down, left and right movements. The eye is housed in the orbit of the skull with the six muscles holding it suspended in place.

There are six voluntary muscles of the orbit, six of which rotate the eye in direction and co-ordinate eye movements. Coordinated eye movements ensure that the retina of each eye receives an image at the same time so that only a single image is perceived. For the human eye to function and move correctly, six muscles must work in unison to provide three-dimensional vision. The six muscles of the eye are:

- Superior rectus
- Medial rectus
- Lateral rectus
- Inferior rectus
- Superior oblique
- Inferior oblique

The six muscles outside the eye govern its movements. These muscles are the four rectus muscles—the inferior, medial, lateral, and superior recti—and the superior and inferior oblique muscles. The rectus muscles arise from a fibrous ring that encircles the optic nerve at the optic foramen, the opening through which the nerve passes, and are attached to the sclera, the opaque portion of the eyeball, in front of the equator, or widest part, of the eye. The superior oblique muscle arises near the rim of the optic foramen and somewhat nearer the nose than the origin of the rectus medialis. It ends in a rounded tendon that passes through a fibrous ring, the trochlea, which is attached to the frontal bone. The trochlea acts as a pulley. The tendon is attached to the sclera back of the equator of the eye.

The inferior oblique muscle originates from the floor of the orbit, passes under the eyeball like a sling, and is attached to the sclera between the attachments of the superior and lateral rectus muscles. The rectus muscles direct the gaze upward and downward

and from side to side. The inferior oblique muscle tends to direct the eye upward, and the superior oblique to depress the eye; because of the obliqueness of the pull, each causes the eye to roll, and in an opposite direction.

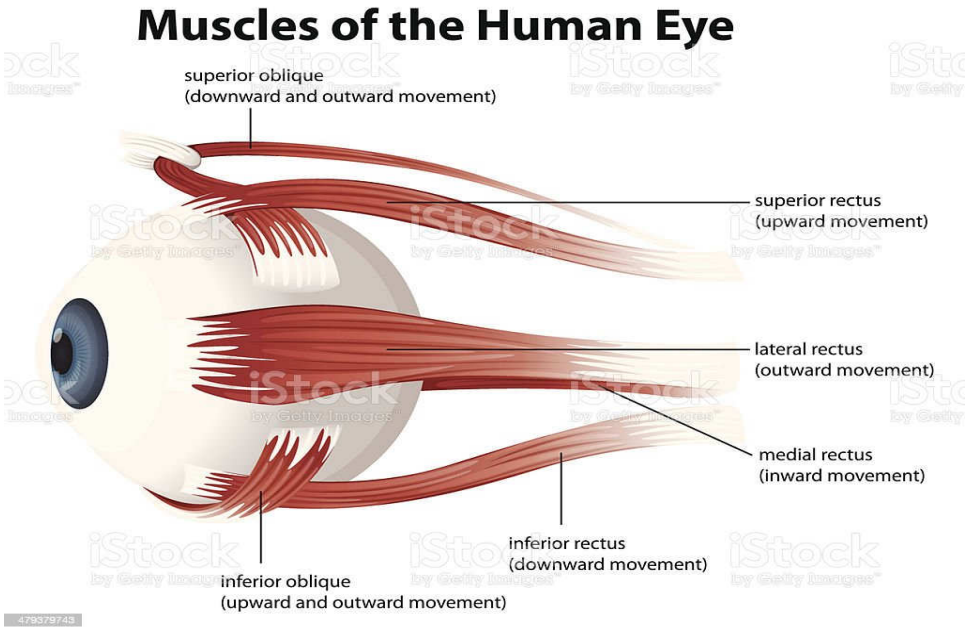

Figure 7: Muscles of the eyes

6.4 Ocular muscles and their functions

1. Levator palpebrae: This muscles lift the upper eyelid
2. Superior rectus: Together with the lateral rectus, this muscles moves the eye diagonally upward toward the side of the head. Together with the media rectus, this muscle moves the eye diagonally upward toward the middle of the head
3. Lateral rectus: Together with the medial rectus, contraction of this muscle holds the eye in a straight position. Contracting alone, the lateral rectus turns the eye towards the side of the head.
4. Medial rectus: Contracting alone, the medial rectus turns the eye towards the nose
5. Inferior rectus: Together with lateral rectus, this muscle moves the eye diagonally downward together the side of the head. Together with the media rectus, this muscle moves the eye diagonally downward toward the middle of the head
6. Superior oblique: Contraction pulls the eye downward
7. Inferior oblique: Contraction pulls the eyes upward

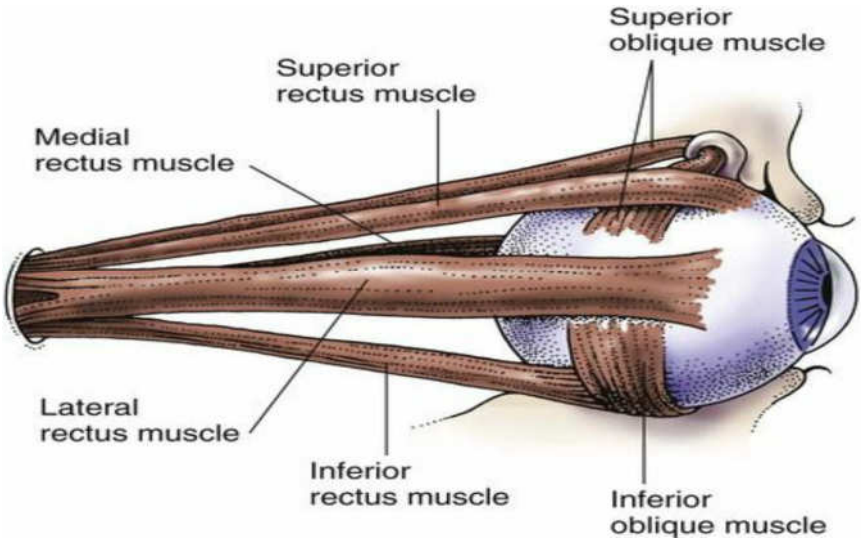

Figure 8: The extra ocular muscles

Table1: Extrinsic muscles of the eye: their actions and cranial nerve supply

Name	Action	Cranial nerve supply
Medial rectus	Rotates eyeball inwards	Oculomotor nerve (3rd cranial nerve)
Lateral rectus	Rotates eyeball outwards	Abducent nerve (6th cranial nerve
Superior rectus	Rotates eyeball upwards	Oculomotor nerve (3rd cranial nerve)
Inferior rectus	Rotates eyeball downwards	Oculomotor nerve (3rd cranial nerve)
Superior oblique	Rotates eyeball downwards and outwards	Trochlear nerve (4th cranial nerve)
Inferior Oblique	Rotates eyeball upwards and outwards	Oculomotor nerve (3rd cranial nerve)

Self-Assessment Exercise 1.

Describe the six (6) muscles of the eye stating how it rotates

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

6.5 How the Eye Muscles Work

The eye muscles work in pairs and movement of the eye muscle is often only a very small movement, a fraction of a degree. The muscles need to be coordinated for vision to be stereoscopic (three-dimensional vision). For example, if you look to the left, the lateral rectus muscle on the left side of your left eye contracts. At the same time, on the right side of the same eye, the medial rectus relaxes.

6.6 Which Muscles Control Which Movements

- Lateral rectus and medial rectus control left and right movements
- Superior rectus and inferior rectus control up and down and medial movements
- Superior oblique and inferior oblique control up and down and outward movements

The four rectus muscles are attached at one end to a fibrous ring that encircles the optic nerve, and the other end of these muscles attaches to the sclera, midline, or widest part of the eyeball.

The superior oblique muscle attaches at one end to the optic foreman (the passage through the orbit of the eye), through the trochlea; a pulley-like structure attached to the frontal bone (the upper part of each orbit) and the other end to the top part of the eyeball. These muscles form a 'cone' within the orbit. The inferior oblique muscle, however, passes under the eye, near the floor of the orbit, and is attached to the eyeball (sclera) in between the superior rectus and lateral rectus.

Self-Assessment Exercise 2.

Enumerate the nerve supplying the six extra ocular muscles. Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

6.7 Eyeball Motion

Normal functioning means that both the eyes look in the same direction at the same time. When looking at an object, both eyes point to the object and the brain deciphers what it is. There are some muscular imbalances that cause the eyes to 'vergence' or 'disconjugate'. This means the eyes move in opposite directions. The two types of vergence are:

1. Convergence — both eyes moving nasally or inward (cross-eyed)
2. Divergence — both eyes moving temporally or outward (wall-eyed)

This problem is known as strabismus (or heterotropia) and a person suffering from strabismus may experience double vision. Often one eye will look at an object and the other eye will point in the opposite direction. Usually, after a time, the brain learns to ignore the messages sent by the eye that is turned the wrong way, and interpret images from the 'good' eye.

Strabismus occurs in approximately 2% of children, or can be as a result of injury, paralyses or retinal disease. If the brain ignores the strabismic eye for a great length of time, this can result in amblyopia (dimness of sight) or 'lazy eye'.

Covering the 'good' eye and making the strabismic eye do all the work is how this condition is generally treated.

6.8 Physiology of Sight

As light waves pass from the air into the eye, it moves sequentially through the cornea, aqueous humour, lens, and vitreous humour, and then it passes through the neural layer of the retina to the photoreceptors behind. The visual pigment in rods is rhodopsin. Rhodopsin forms and accumulates in the dark, as vitamin A is oxidised to the 11-cis retinal form, and then combined with opsin to produce rhodopsin.

When rhodopsin absorbs light, it triggers a series of steps in which retinal changes shape from the 11-cis to the all-trans form, and releases opsin. Free opsin then acts enzymatically to catalyse the activation of the G protein transducin. In turn, transducin catalyses the activation of the enzyme phosphodiesterase, which hydrolyses cGMP to GMP, so removing it from the Na+ channels, and consequently causing them to close. This prevents Na+ from diffusing into the cell, resulting in hyperpolarisation, which in turn prevents neurotransmitter release at the cell's synapse with bipolar neurons.
Like rods, the visual pigments of cones are a combination of retinal and opsins, which associate and dissociate as part of a light dependent cycle. There are three different types of cone: blue, green and red. Each has a distinct type of opsin, and each responds to a different optimal wavelength, at which the opsin and retinal dissociate.
Overlap between their wavelength ranges, and stimulation of more than one cone type results in us perceiving intermediate colours such as yellow and purple. As in rods, light stimulated dissociation of retinal and opsin triggers the G protein mediated cascade of events that results in hyperpolarisation and light perception by the brain.

6.9 Summary

This unit has presented to you the muscles that are responsible for the movement of the eyes. In particular, the diagrammatic representation provided an opportunity to examine the workings of the eye with its attending nerves supply to each of the muscles. It hoped that you have tried your hands in drawing the diagram of the muscles yourself. If not you are advised to do so.

6.10 References/Further Readings/Web Sources

Scanlon, V. V & Sanders, T. (2007). Essentials of anatomy and physiology (5th edition). Sanders
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6.11 Answers to Self-Assessment Exercise(s)

Answers to Self-Assessment Exercises 1: Describe the six (6) muscles of the eye stating how it rotates

- Superior rectus
- Medial rectus
- Lateral rectus
- Inferior rectus
- Superior oblique
- Inferior oblique

- Lateral rectus and medial rectus control left and right movements
- Superior rectus and inferior rectus control up and down and medial movements
- Superior oblique and inferior oblique control up and down and outward movements

Answers to Self-Assessment Exercise 2.

Medial rectus- Oculomotor nerve (3rd cranial nerve)
Lateral rectus- Abducent nerve (6th cranial nerve
Superior rectus- Oculomotor nerve (3rd cranial nerve)
Inferior rectus- Oculomotor nerve (3rd cranial nerve)
Superior oblique- Trochlear nerve (4th cranial nerve)
Inferior Oblique- Oculomotor nerve (3rd cranial nerve)

Unit 7: Basic refraction

Unit Structure

7.1 Introduction

Sight is our most important sense. Without sight, we would be unlikely to survive without help. The quality of a person's vision significantly affects the way they manage their daily life, as many common tasks like cooking are more difficult if, for example, the long-sighted cook has no reading glasses; similarly a customer in a restaurant cannot read a menu without reading glasses.
Understanding how light is refracted within the eye is key to understanding the visual needs of our patients, particularly when it comes to obtaining accurate intraocular lens readings and understanding spectacle prescriptions and associated visual difficulties.

7.2 Learning Outcomes

7.3 Refraction

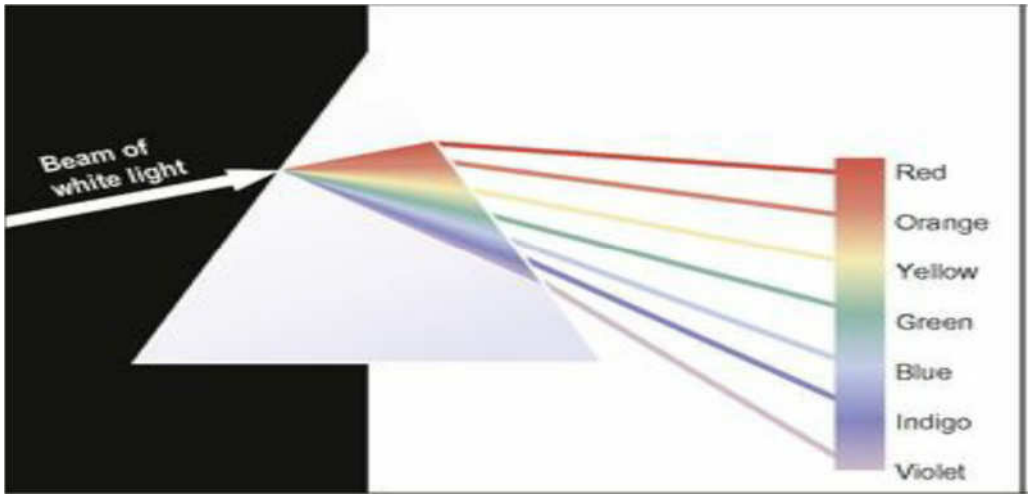

Figure 9: Refraction

Refraction is the bending of light rays of the eye, allowing light from the environment to focus on the retina. The light from a large area can be focused on a small area. Refraction bends light rays from the outside into the eye through curved surfaces and refractive media and finally to the retina. Each surface and media bend (refract) light differently to focus an image on the retina. Emmetropia is the perfect refraction of the eye in which light rays from a distant source are focused into a sharp image on the retina. Figures below shows the normal refraction of light within the eye. Images fall on the retina inverted and reversed left to right. For example, an object in the lower nasal visual field strikes the upper outer area of the retina. Figure Refraction and correction in emmetropia, hyperopia, and myopia.

Self-Assessment Exercise 1.

1. State and explain the four basic processes that are necessary to form an image.
2. What is the medical term for double vision?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

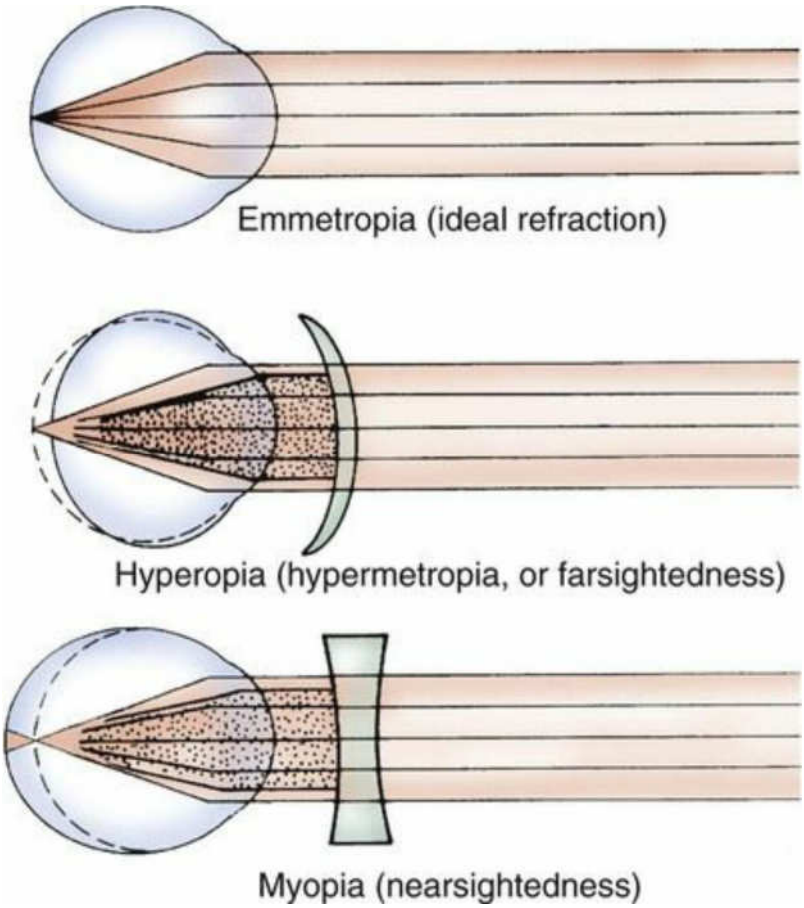

Figure 10: Refraction and correction in emmetropia, hyperopia, and myopia.

7.4 Focusing the eye for near vision

This involves:

Pupil constriction:

To assist with accommodation, constriction of the diameter of the pupil must occur to prevent light from entering the periphery of the lens. If light entered the periphery, it would not focus on the retina and the image would be blurred.

Smaller pupil diameters result in an increased depth of focus and an improved retinal image.

Convergence:

Convergence is the movement of both eyes medially to allow light rays from an object to hit the same points on both retinas. The extrinsic eye muscles control this movement. As the object becomes closer, the eyes turn toward the nose, this allows binocular vision (seeing the same object with both eyes).

Accommodation:

The process of accommodation is the focusing for near vision objects (less than 20 feet away). For near vision to occur, the ciliary muscle must contract, which pulls the choroid toward the lens, thus causing the lens to shorten and thicken and giving it a convex appearance. This allows the lens to bend light rays toward the fovea contrails.

When we look at objects near to us, diverging light rays reach our corneas so the eye requires more refractive power to focus the light on to the retina (but parallel light rays come from objects in the distance).

7.4.1 Emmetropia (normal sight)

The refractive components of the normal eye are able to focus light from a distant object (parallel light) on the retina accurately, so that the person is able to see distant objects clearly without spectacles. When a person is young and has 'normal' accommodation they will also be able to read without spectacles. However, with age even 'normal'-sighted people have decreased ability to accommodate (presbyopia) which means that spectacles will be needed for close work.

7.4.2 Ammetropia (refractive error)

This term indicates a variation in the shape of the eye that interferes with accurate light refraction.

Refractive errors generally occur as a result of eye shape rather than disease. Factors affecting the possibility of someone having (or developing) a refractive error include their age, whether their parents were long- or short-sighted, their race and the environment they live and work in. For example, people who live and work for days in confined spaces such as underwater diving bells and submarines tend to develop myopia. This may pass off to some extent following a return to a normal environment

7.4.3 Myopia (short-sightedness)

A myopic eye may have an eyeball that is longer than normal or have a cornea that is too convex so that the light rays come to a focus in front of the retina. The result is that close objects look clear, while objects further away look blurred.

7.4.4 Hypermetropia (long-sightedness)

A hypermetropic eyeball may be shorter than normal or the cornea may not be convex enough. When looking into the distance the person must use the natural power of their lens to see clearly. Because the hypermetropic person already has to use most of their natural focusing power to see in the distance, they are less able to see near objects clearly. As with short sight, long sight is usually inherited. Babies and young children tend to be naturally slightly long-sighted. As they grow, the eye lengthens a little and their hypermetropia reduces. As young people they can often use the focusing power of their eyes to overcome the problem of hypermetropia. However, in their late teens and early 20s, the lens begins to become a little harder and they may then require spectacles. If you have hypermetropia, your prescription will have a positive value

7.4.5 Astigmatism

Astigmatism is caused when the front of the eye is not completely spherical. It can be because the cornea or lens curves more in one direction than in the other, with resulting

distortion when viewing both distant and near objects. It is possible to have some degree of astigmatism in one or both eyes, as well as being either hypermetropic or myopic. It is a fairly stable condition, which changes only slightly over a lifetime. Any eye surgery that involves a corneal incision can create or alter astigmatism.

7.4.6 Anisometropia

This is normally a congenital condition in which the two eyes have unequal refractive powers. A person might be very hypermetropic in one eye, and less so in the other. One eye may even be myopic and the other hypermetropic.
Anisometropia in a young child can cause amblyopia (in anisometropia the amblyopia normally only affects one eye). Amblyopia develops because eyes can only accommodate by an equal amount. If the eyes have unequal refractive powers one eye will normally receive a clearer image than the other. For example if a child's right eye is +1.00 and his or her left eye is +3.00, then both eyes will accommodate by +1.00 dioptre. The right eye will then be focused but the image in the left eye will remain 2 dioptres out of focus. The brain will concentrate on using the vision from the eye with a more focused image (in this example the right eye), but will not use the less focused image from the other eye as much (in this example the left eye). The eye with the less focused image becomes amblyopic (or lazy) because vital visual connections in the brain are not stimulated to form images. Amblyopia develops in childhood as the brain's visual connections mature with age. By the age of about 8 years the potential for good vision will remain even if anisometropia develops, but any amblyopia already present will remain throughout life. Different image sizes are of course, only one of several reasons for the development of amblyopia in children.
In adults, a difference in the required spectacle prescription of both eyes of about 3 dioptres can lead to diplopia (double vision) as the brain will perceive a different sized image from each eye and there will be different optical effects in each eye from the unequal spectacle lenses that the brain finds difficult to interpret.

7.4.7 Presbyopia (ageing eyes)

The lens of the eye continues to grow throughout life, and its inner fibres become tightly compacted. The lens becomes less flexible and therefore its shape is less able to be changed via contraction and relaxation of the ciliary muscle. These changes start to become noticeable by the time a person reaches their 40s. Because the lens no longer focuses for near vision as well as it used to, the person will begin to hold their reading material (e.g. the daily newspaper) further away from their face in an attempt to read. Eventually reading spectacles or bifocal lenses will be needed.
On average, the strength of reading spectacles required to correct presbyopia is +1.5 to +2.50 dioptres. Check this out next time you see a display of reading spectacles in a shop.

Self-Assessment Exercises 2:

1. Emmetropia is another name for what?
2. What are the medical terms for long sight and short sight, respectively?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes.

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

7.5 Objective and subjective refraction

There are various ways of testing a patient's eyes for spectacles.

Objective refraction

Objective refraction does not need any response from the patient and is obtained from:

- Cycloplegic refraction: This may be used for young children and babies as well as people with learning difficulties. Cyclopentolate eye-drops are instilled to prevent accommodation (an additional effect of these drops is to dilate the pupil). The patient is then examined with a retinoscope. Babies and young children may be refracted while anaesthetised (if anaesthetised for other reasons). This is why theatre staff may need a lens box when a child is being examined under anaesthetic.
- Retinoscopy: An optometrist or ophthalmologist uses a retinoscope to observe the direction of reflected light from the retina. Neutralising the light movement using trial lenses gives an indication of the power of the eye. Adults are asked to relax their eyes in a darkened room and look at a green light at the end of the room. This stops them changing the focus of their eyes during the examination. For an experienced professional this is a quick and accurate method for generating a prescription. People who have had cyclopentolate eye-drops are asked to look straight at the retinoscope light because they are unable to accommodate.

Subjective refraction

This is when the optometrist asks a patient to respond to changes in the power of lenses, by asking if vision is clearer or more blurred with, for example, lens one or lens two. It is normal for an optometrist to examine both objectively and subjectively. They are checking that the prescription is accurate in order to provide the patient with clear comfortable vision.

7.6 Summary

Not only is it important that you understand the basics of refraction to understand variable spectacle prescriptions, but you also need to remember that some eye conditions may be linked to refractive errors which is highlighted in this unit. For example, people who develop retinal detachments are more likely to be myopic, and

those developing primary acute closed-angle glaucoma will tend to be long-sighted. It is very important to understand a little about refraction.

7.7 References/Further Readings/Web Sources

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7.8 Answers to Self-Assessment Exercise(s)

Self-Assessment Exercises 1:

1. State and explain the four basic processes that are necessary to form an image.

Refraction

Refraction is the bending of light rays of the eye, allowing light from the environment to focus on the retina. The light from a large area can be focused on a small area.

Accommodation

The process of accommodation is the focusing for near vision objects (less than 20 feet away). For near vision to occur, the cilliary muscle must contract, which pulls the choroid toward the lens, thus causing the lens to shorten and thicken and giving it a convex appearance. This allows the lens to bend light rays toward the fovea contrails.

Constriction

To assist with accommodation, constriction of the diameter of the pupil must occur to prevent light from entering the periphery of the lens. If light entered the periphery, it would not focus on the retina and the image would be blurred.

Convergence

Convergence is the movement of both eyes medially to allow light rays from an object to hit the same points on both retinas. The extrinsic eye muscles control this movement. As the object becomes closer, the eyes turn toward the nose, this allows binocular vision (seeing the same object with both eyes).

2. What is the medical term for double vision?

- Diplopia

Answers to Self-Assessment Exercises 2:

1. Emmetropia is another name for what?
   - Normal sight
2. What are the medical terms for long sight and short sight, respectively?
   - Long sight- Hypermetropia
   - Short sight- Myopia

End of the Module Questions

Describe the six (6) muscles of the eye stating how it rotates

MODULE 3: COMMON AILMENTS RELATED TO THE OUTER LAYER OF THE EYE

Module Structure

UNIT 8: Common Ailments Related to the Outer Layer of the Eye

MODULE 3: COMMON AILMENTS RELATED TO THE OUTER LAYER OF THE EYE

Unit 8: Common ailments of the Outer Eye

8.1. Introduction

Having had a good understanding of the anatomy and physiology of the human eye particularly the structures, we will in this unit consider the different parts of the outer eye and the common eye defects.

8.2. Learning Outcomes

At the end of this unit, the learner will be able to:

- Identify the parts of the outer eye
- Highlight the common ailments of the outer eye
- Understand the management of the defects

8.3 Main Content: Outer part of the eye and its functions

Outer part

- Eyebrow which prevents the sweat from the forehead
- Eyelids which cover the eyes when not in use
- Eyelashes which catch dirt to prevent it from getting into the eyes

Visible part

- Cornea is the outer layer of an eye. It is thin and transparent.
- Iris lies behind the cornea and it is the coloured part of the eye
- Pupil controls the amount of light that enters the eye. It is black and round.
- Aqueous humour is a thick liquid that nourishes the bloodless, transparent cornea and the lens

Inner part

- Vitreous humour is a thick substance between the lens and the retina
- Retina is the innermost layer of the eyeball situated behind the vitreous humour.
- Optic nerve is the nerve cell that joins at the back of the retina. It sends message to the brain.

8.4 Common eye defect

Refractive Errors

In refractive errors, vision is impaired because a shortened or elongated eyeball prevents light rays from focusing sharply on the retina. Blurred vision from refractive error can be corrected with eyeglasses or contact lenses. The appropriate eyeglass or contact lens

is determined by refraction. Refraction ophthalmology consists of placing various types of lenses in front of the patient's eyes to determine which lens best improves the patient's vision. The depth of the eyeball is important in determining refractive error. Patients for whom the visual image focuses precisely on the macula and who do not need eyeglasses or contact lenses are said to have emmetropia (normal vision). People who have myopia are said to be near-sighted. They have deeper eyeballs; the distant visual image focuses in front of, or short of, the retina. Myopic people experience blurred distance vision. When people have a shorter depth to their eyes, the visual image focuses beyond the retina; the eyes are shallower and are called hyperopic. People with hyperopia are farsighted. These patients experience near vision blurriness, whereas their distance vision is excellent.

Another important cause of refractive error is astigmatism, an irregularity in the curve of the cornea. Because astigmatism causes a distortion of the visual image, acuity of distance and near vision can be decreased. Eyeglasses with a cylinder correction or rigid or soft toric contact lenses are appropriate for these patients.

- Near-sightedness (myopia): In near-sightedness, there is long eyeball with concave lenses near object clear but far object blurred.
- Farsightedness (hyperopia): There is short eyeball, convex lenses and near object not seen but far object clear.
- Astigmatism: There is abnormal corneas with clear but eyestrain and headaches
- Strabismus: There is cross-eye and wall-eye. Eye exercise by paediatrician needed to correct defect.
- Colour blindness: There is difficult in distinguishing colours
- Style: This is an infection with fever, swelling and Inflammation
- Conjunctivitis: There is pink eye, crusty eyelids, pain swelling, very itchy and water discharge.

8.5 Diagnosis of Eye Infections

Instructions

Step 1: Look for signs of conjunctivitis, more commonly known as pink eye.
Symptoms include irritation, redness of the eye, tearing or yellowish discharge. Pink eye is extremely contagious.
Step 2: Observe signs of a stye, which is a small bump on the eyelid.
Symptoms include tenderness and redness around the bump, discomfort, light sensitivity and tearing.
Step 3: Watch for corneal inflammation. This could be keratitis and can occur with adults, as well as children. Keratitis does not usually affect a healthy eye, but it can occur if there is a scratch on the eye or if the eye is very dry. Symptoms include pain, swelling of the eyelid, blurred vision, redness and light sensitivity.
Step 4: Detect whether you have dry eyes by looking for certain symptoms.
These symptoms may include itching, a burning sensation, irritation, excessive tearing or blurred vision. Dry eyes are caused by environmental conditions, cigarette smoke, contact lenses or reading for an extended period of time.
Step 5: Spot symptoms such as itching, swelling and irritation of the eyelids.

These are common symptoms of blepharitis. Blepharitis is eyelid inflammation that can be chronic. Staphylococcus and seborrhoea are the two types of the illness. Staphylococcus blepharitis starts during childhood and is caused by bacteria. Seborrhoea blepharitis is caused by abnormal tear film.
Step 6: Examine few cases of the outer eye namely: conjunctivitis, corneal ulcer and Dry eye (Cicatria).

8.6 Eye defects of the outer parts

8.6.1 Conjunctivitis

Conjunctivitis is an infection or inflammation of the conjunctiva. Conjunctival infections may be caused by bacterial, viral or chlamydial microorganism. Conjunctival inflammation may result from exposure to allergens or chemical irritants (including cigarette smoke). The tarsal conjunctiva (lining the interior surface of the lids) may become inflamed as a result of a chronic foreign body in the eye, such as a contact lens or an ocular prosthesis.
We have all felt the uncomfortable feeling in the eyes; it is also called the “pink eye or Apollo”, a magic word that meant you are not going to school for a couple of days. In ophthalmic practice it is called conjunctivitis.

How to Identify Conjunctivitis

Instructions

Step 1: Observe whether there is redness of the eye. The eye takes on a bloodshot appearance at first. This is usually the most notable symptom of conjunctivitis.
Step 2: Notice if there is watering of the eye. Pinkeye usually begins in one eye then quickly spreads to the other. Along with redness watering of the eye is one of the initial symptoms.
Step 3: Notice if there is itching of the eye. People who are affected with conjunctivitis often rub the eye due to the itching that occurs. Frequent rubbing of the eye only increases the redness, makes the eye sore and may cause the infection to spread to the other eye through touching with unwashed hands.
Step 4: Observe whether there is pain in the eye. Pain sometimes occurs with conjunctivitis. The pain may be most noticeable on blinking or moving the eye up, down or to the side. It may also feel as if something is in the eye, especially when blinking.
Step 5: Notice the effect on your vision. People affected by conjunctivitis often experience blurred vision and/or the inability to focus properly with the affected eye.
Step 6: Notice whether there is a pus-like discharge present. The discharge that occurs with pinkeye may be thick or stringy. As it dries it forms a crust that can cause the eyelids to stick together. This often occurs at night while sleeping. On awakening in the morning the person may find their eyelids stuck together and must moisten them with a warm cloth to remove the crusty residue.
Step 7: Notice whether a sore throat or cold-like symptoms are present.

These symptoms may occur with forms of conjunctivitis that are caused by a viral or bacterial infection. Conjunctivitis that is caused by allergies or irritation usually clears up on its own within a few days. If you experience any symptoms of conjunctivitis you should see a physician for proper diagnosis and treatment

Pinkeye (Causes)

1. Viral Infection

Viruses that cause pinkeye are usually associated with accompanying cold or flu-like symptoms. The main difference between viral and bacterial conjunctivitis is the discharge. Viral infections are normally clear and watery while bacterial infections have a thick green or yellow mucus excretion. Viral pinkeye infections may also be accompanied by sinusitis symptoms and swollen eyelids.

2. Bacterial Infections

There are three main sources of bacterial pinkeye: staphylococci, pneumococci and streptococci. Bacterial infections are the cause of the crusty discharge patients experience during sleep.

3. Chlamydia and Gonorrhoea

If a mother is infected with Chlamydia or gonorrhoea, her baby may be born with Chlamydia or gonococcal pinkeye. In these cases, antibiotic treatment should begin immediately. Pinkeye can also be sexually transmitted.

4. Allergic Reactions

Allergic reactions can cause the tearing, redness and swelling associated with allergic conjunctivitis. Pollen, dust, mould and animal dander lead to inflammation of the conjunctiva in allergy patients.

5. Irritants

Irritants such as cigarette smoke, aerosols, household cleaners and industrial waste products can cause the redness, swelling and itchiness associated with pinkeye. The eye should be washed out with water to remove the chemicals or other irritants.

6. Disease

Chronic diseases can lead to pinkeye symptoms. Chronic cases of pinkeye can be a symptom of an undiagnosed disease. Autoimmune disorders such as rheumatoid arthritis and systemic lupus bring out the symptoms of pinkeye.
Conjunctivitis has also been associated with diseases common in children, such as Kawasaki's disease, colitis and Crohn's disease.

Requirements for face washing

- Washcloth
- Bowl
- Hot water
- Sterile cotton balls
- Baby shampoo
- Antihistamine
- Prescribed antibiotic ointment

Step 1: Wash the red away from the eye. A warm compress applied to the eyes for 5 to 10 minutes three or four times a day will make the patient feel better.
Step 2: Keep the affected eyes clean. A lot of times conjunctivitis gets better all by itself, but to help the healing process along, keep the eyes and eyelids clean by using a cotton ball dipped in clean or sterile water to wipe the crusts away.
Step 3: Bath the eyes. A warm compress works well for children, but sometimes adults need a little something more. Adults who have a lot of discharge should make a solution of 1 part baby shampoo to 10 parts warm water. Dip a sterile cotton ball into the solution and use it to clean off your eyelashes, this works well.
Step 4: Don't chlorinate the eyes. The chlorine in swimming pools can cause conjunctivitis, but without the chlorine, bacteria would grow and this could cause pinkeye too. Advice those who goes swimming in a chlorinated pool that they are susceptible to conjunctivitis. They should wear tight fitting goggles while in the water.

Precautions:

- If after five days the infection is getting worse, not better, refer the patient to the Eye Clinic
- If you come across a patient with red eye and significant eye pain, change in vision, or a copious amount of yellow of greenish discharge, immediately refer him/her to the Eye Clinic.

8.6.2 Corneal ulcers

Eyes are under major threat and are possibly the most taken for granted part of our body. Amongst the most serious eye diseases is corneal ulcer. It may lead to complete blindness and is also life threatening. In this condition the cornea, which is the transparent layer of the outer eye, gets infected. It is also called as eyesore or ulcerative keratitis.
In corneal ulcer, the epithelial layer of the cornea is disrupted. The cornea is responsible for refraction of the light that is received by the eyes. The transparent layer cornea carries pressure points as well as pain receptor.
Therefore development of corneal ulcers is extremely painful and unbearable. The eye may show aqueous flare and redness of the eye. Since the pain receptors are stimulated, there occurs release of substances like acetylcholine, histamine and prostaglandin.
The ulcer can be clearly seen under a Slit lamp. Schirmer's test is also performed in order to check for any other acute possibility. Rose Bengal dye and flourescein dye are

also used to do checks on corneal ulcer. Flourescein stain is used to understand the spread of the ulcer.
The body does try to heal the ulcers. This is done in two ways. One is to introduce more blood vessels from the conjunctiva region. The second is to cause migration of the nearby epithelial cells. This is preceded by mitosis. If this is done successfully, the ulcer is healed by the fourth day. There are various types of corneal ulcers. These include superficial and deep corneal ulcers, Refractory corneal ulcers and melting ulcers. Although corneal ulcers are a common eye disease still, they have been avoided if proper eye care is done.
Eating of balanced diet which includes lots of fresh green vegetables provide vitamin A and C which helps in strengthening eyes. Since it is difficult to eat balanced diet everyday supplementation must be made an essential of the daily regime.

8.6.3 Dry Eyes

Dry eye occurs when the eye cannot produce enough tears to keep the eye wet and comfortable. Stinging, burning, scratchiness, stringy mucus, and excess irritation from smoke are usual symptoms. Problem with contact lenses can be cause by dry eyes and make it impossible to wear contact lenses at all.
Surprisingly, increased tearing may be a symptom of dry eyes. If the basic tear secretion is below normal, excess tears are produced by the lacrimal gland in response to irritation. Even though the eye is basically dry, overflow tearing can occur, masking the dryness, which caused them in the first place.
Dry eye is a common ailment that can occur after refractive surgery. You of course know that tears run from eyes when you cry or when the eyes are irritated. But tears have a much more important everyday function. A film of tears, spread over the eye by a blink, makes the surface of the eye smooth and optically clear. Without our tear film, good vision would not be possible.

1. **The Outer Oily Layer**

There are three layers in the thin film of tears which coat the surface of the eye, an oily layer, a watery layer, and a layer of mucus. The outermost layer of the tear film is produced by small gland at the edge of the eyelid, called meibomian glands. The main purpose of this oily layer is to smooth the tear surface and reduce evaporation of tears.

2. **The Middle Watery Layer**

The middle layer, and largest of the three, makes up most of what we ordinarily think of as tears. This watery layer is produced by small glands scattered through the conjunctiva, which is the delicate membrane lining the inside of the eyelid and covering the eyeball, and by the major tear gland called the large lacrimal gland. This layer cleanses the eye and washes away foreign particles or irritants.

3. **The Inner Mucus Layer**

The innermost layer consists of mucus produced by other cells in the conjunctiva. This layer allows the watery layer to spread evenly over the surface of the eye and helps the eye to remain we. Without mucus, tears would not adhere to the eye.

Kinds of Tears

There are at least two kinds of tear:

- Those that lubricate the eye and those that are produced as a "reaction" to irritation or emotion.
- Tears, which lubricate the eye, are produced around the clock. Excessive tears occur when a foreign body irritates the eye or when a person experiences extremes of emotion, as in crying.

Causes of Dry Eye

- Normally, tear production decreases with age.
- Dry eyes are more common in women, especially after the age of menopause, but can occur at any age in both men and women.
- Dry eye can also be associated with arthritis. In addition, the inside of the mouth may become dry due to inadequate production of saliva. Swallowing or eating food then becomes difficult.
- Patient with dry eyes, dry mouth, and arthritis are said to have Sjogren's syndrome.
- Drugs and medication can also cause dry eyes by reducing tear secretion. Since these medications are often necessary, the dry eye condition may have to be tolerated or treated with "artificial tears." For a listing of drugs that can cause dry eyes, please refer to the last section of this unit

Diagnosis of Dry Eyes

Often an eye care professional is able to diagnose dry eyes by simply examining the eyes. Sometimes tests, which measure tear production, may be necessary. One widely used test involves the placement of filter paper strips under the lower eyelids to measure the rate of tear production under various conditions.

Treatment for Dry Eye

- The basis of treatment is replacement with artificial tears.
- Artificial tears are available without a prescription and are used as eye drops to lubricate the eyes and replace the missing moisture.
- There are many brands of artificial tears on the market, may be used as often as necessary, only once or twice a day, or as often as several times an hour.
- Solid inserts that gradually release lubricants during the day are also beneficial to some patients.

- Conserving the tears, which are naturally produced, is another approach to keeping the eye moist.
- Tears leave the eye through tear ducts in both eyelids and go down into the nose.
- These channels may be closed by eye care professional to create a blockage which will keep the eyes moist for longer periods of time.
- Preventing the evaporation of tears can also prove helpful.
- In winter, when the heat is turned on, a humidifier or a pan of water on the radiator may help add moisture to the air.
- Wrap-around glasses (illegal to wear while driving in some states) may cut down evaporation of eye moisture due to wind.
- Anything that adds to dryness such as an overly warm room, hair dryers, windy days, or anything that adds an irritant to the air will make a person with dry eyes more uncomfortable. Smoking is especially bothersome.
- Scratchiness that is bothersome on first opening the eyes in the morning can be treated by using an ointment at bedtime.
- This can cause temporary blurring of vision; so many people use the least amount necessary to provide relief.
- Ointments containing Vitamin A are currently under investigation as treatment for dry eye, and early results are encouraging.

Please note that extreme dryness can cause serious damage to the eye. An examination and diagnosis by the eye specialists: ophthalmologists and ophthalmic nurse will provide the needed care for a dry eye.

Drugs that can cause Dry Eye

The following drugs may cause dry eye. Brand names may be different from the generic or clinical names listed below:

Acetophenazine	Diethazine	Methyldopa	Propranolol
Amitriptyline	Dimethendene	Methylthiouracil	Protriptyline
Antazoline	Diphenhydramine	Metoprolol	Pyrilamine
Atropine	Diphenylpyraline	Morphine	Scopolamine
Azatadine	Doxylamine	Nitrous Oxide	Tetrahydrocannabinol
Belladonna	Ether	Nortriptyline	THC
Beta-blockers	Ethopropazine	Opium	Thiethylperazine
Bromphreniramine	Fluphenazine	Oxprenolol	Thioproperazine
Carbinoxamine	Hashish	Perazine	Thiordazine
Carphenazine	Hexamethonium	Periciazizne	Thirporpazate
Chlorisondamine	Homatropine	Perphenazine	Trichloroethylene
Chlorpheniramine	Imipramine	Pheniramine	Trifluoperazine
Chlorpromazine	Isoretinoin	Piperacetazine	Trifupromazine
Clemastine	Marijuana	Practolol	Trimeprazine
Cyroheptadine	Mesoridazine	Prochlorperazine	Tripelennamine
Desipramine	Methdilazine	Promazine	Triprolidine

Dexbrompheniramine	Methotrimeprazine	Promethazine	
Dexchlorpheniramine	Metscopolamine	Propiomazine	

Self-Assessment Exercises 1:

Match the term listed in column II with its associated definition listed in column I.

	Column I		Column II
1	Another term for an external hordeolum	a	Eyeglasses
2	--------- is the outer layer of an eye. It is thin and transparent.	b	Photophobia
3	Blurred vision from refractive error can be corrected with ---	c	Sinusitis
4	Abnormal sensitivity to light	d	Cornea
5	----is a common ailment that can occur after refractive surgery.	e	Sty
6	Slit lamp can easily detect ----------	f	Artificial tears
7	The basis of treatment of dry eyes is replacement with ----	g	Astigmatism
8	An important cause of refractive error is	h	Dry Eye
9	---------- is used to understand the spread of the ulcer.	i	Cornea Ulcer
10	Viral pinkeye infections may also be associated with -----	j	Flourescein stain

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

8.6.4 Hordeolum

A hordeolum, or stye, is infection of the eyelid sweat glands (external hordeolum) or of the eyelid sebaceous gland (internal hordeolum). A red, swollen, painful area occurs on the skin surface side of the eyelid. The most common causative organisms are Staphylococcus aureus, Staphylococcus epidermidis, and Streptococcus. Visual sensory perception is not affected.

Management includes applying warm compresses 4 times a day and an antibacterial ointment. When the lesion opens, the purulent material drains and the pain subsides.

Nursing interventions include instructing the patient how to apply compresses to the eye and how to instil antibiotic ointment. Remind the patient to remove the ointment from the eyes before driving or operating machinery.

3.6.5 Chalazion

A chalazion is an inflammation of a sebaceous gland in the eyelid. It begins with redness and tenderness, followed by a gradual painless swelling. Later, redness and tenderness are not present. Most chalazia protrude on the inside of the eyelid. The patient has eye fatigue, light sensitivity, and excessive tears.
Management includes applying warm compresses 4 times a day, followed by instillation of ophthalmic antibiotic ointment. If the chalazion is large enough to affect vision or is cosmetically displeasing, it may be removed surgically. Instruct the patient to immediately report increasing redness, purulent drainage, or reduced vision to the ophthalmologist.

8.7 Summary

This unit has considered the topic common ailments affecting the components of the eye. This include conjunctivitis, corneal ulcer, dry eye, hordeolum (stye) and chalazion. We shall take on other common ailments in the next unit.

8.8 References/Further Readings/Web Sources

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8.9 Answers to Self-Assessment Exercises

Self-Assessment Exercises 1:

Match the term listed in column II with its associated definition listed in column I.
1. e
2. d
3. a
4. b
5. h
6. i
7. f
8. g
9. j
10. c

UNIT 9 - COMMON AILMENTS RELATED TO THE MIDDLE LAYER OF THE EYE

Unit 9: Common ailments related to the Middle Eye

9.1 Introduction

We have just touched on few common ailments relating to the outer layer of the eye. In this unit we shall examine an overview of the middle layer and then consider common ailments relating to it. It is hoped you will follow systematically to grasp the required information to make you a provider of eye care in your domain.

9.2 Learning Outcomes.

At the end of this unit, the learner will be able to:

- Describe an overview of the middle layer
- Identify common ailments of the middle layer
- Understand the methods of treating the ailments

9.3 Overview of the Middle Layer of the Eye

The middle layer of the eye-wall is the choroid. It consists of many blood vessels. They transfer the nutrients to the right place and regulate the temperature. The choroid first enters the corpus ciliary and then the iris. The iris determines the colour of the eyes. It can be compared to the diaphragm of a camera. In the centre of the iris is an opening: the pupil. Orbicular muscles make the opening wider or smaller. When there is much light, the pupil becomes more narrow. At twilight or darkness the pupil widens. So the pupil is an opening, although it seems to be black. That colour exists because the eye doesn't reflect the light that enters.

Behind the iris is the lens. It is kept at its place by very small fibres. The lens surely is transparent. It has the shape of a globoid. The inner eye muscles can change the globoid of the lens and that way sharpen the incoming image. Iris and lens divide the eye into the foremost and the rear chamber of the eye.

9.3.1 Amblyopia

Amblyopia is poor vision in an eye that did not develop normal sight during early childhood. It is sometimes called "lazy eye." When one eye develops good vision while the other does not, the eye with poorer vision is called amblyopic. Usually, only one eye is affected by amblyopia, but it is possible for both eyes to be "lazy."
The condition is common, affecting approximately two or three out of every 100 people. The best time to correct amblyopia is during infancy or early childhood.

Causes of amblyopia

Amblyopia is caused by any condition that affects normal use of the eyes and visual development. In many cases, the conditions associated with amblyopia may be inherited.
Amblyopia has **three major causes:**
1. Strabismus (misaligned eyes)
Amblyopia occurs most commonly with misaligned or crossed eyes. The crossed eye "turns off" to avoid double vision, and the child uses only the better eye. The misaligned eye then fails to develop good vision. Amblyopia occurs when one eye is out of focus because it is more near sighted, farsighted or astigmatic than the other.
The unfocused (blurred) eye "turns off" and becomes amblyopic. The eyes can look normal, but one eye has poor vision. This is the most difficult type of amblyopia to detect since the child appears to have normal vision when both eyes are open.
Amblyopia also can occur in both eyes if both eyes are very blurred. This can happen when there is a high amount of near sightedness, farsightedness or astigmatism. This is called bilateral refractive amblyopia.

2. Cloudiness in the Normally Clear Eye Tissues (Cataract)
An eye disease such as a cataract (a clouding of the eye's naturally clear lens) may lead to amblyopia. Any factor that prevents a clear image from being focused inside the eye can lead to the development of amblyopia in a child. This is often the most severe form of amblyopia.

Diagnosis of amblyopia

It is not easy to recognize amblyopia. A child may not be aware of having one strong eye and one weak eye. Unless the child has a misaligned eye or other obvious abnormality, there is often no way for parents to tell that something is wrong.
Amblyopia is detected by finding a difference in vision between the two eyes or poor vision in both eyes. Since it is difficult to measure vision in young children, your ophthalmologist often estimates visual acuity by watching how well a baby follows objects with one eye when the other eye is covered.
Using a variety of tests, the ophthalmologist observes the reactions of the baby when one eye is covered. If one eye is amblyopic and the good eye is covered, the baby may attempt to look around the patch, try to pull it off, or cry.

Poor vision in one eye does not always mean that a child has amblyopia. Vision can often be improved by prescribing glasses for a child.
The Ophthalmologist will also carefully examine the interior of the eye to see if other eye diseases may be causing decreased vision.
These diseases include:

- Cataracts
- Inflammations
- Tumours
- Other disorders of the inner eye

Treatment of amblyopia

1. To correct amblyopia, a child must be made to use the weak eye. This is usually done by patching or covering the strong eye, often for weeks or months.
2. Even after vision has been restored in the weak eye, part-time patching may be required over a period of years to maintain the improvement. Glasses may be prescribed to correct errors in focusing. If glasses alone do not improve vision, then patching is necessary.
3. Amblyopia also may be treated by blurring the vision in the good eye with special eye drops or lenses to force the child to use the amblyopic eye. Amblyopia is usually treated before surgery to correct misaligned eyes, and patching is often continued after surgery as well.
4. If the ophthalmologist finds a cataract or other abnormality, surgery may be required to correct the problem. An intraocular lens may be implanted. After surgery, glasses or contact lenses can be used to restore focusing while patching improves vision.
5. Amblyopia cannot usually be cured by treating the cause alone. The weaker eye must be made stronger in order to see normally. Prescribing glasses or performing surgery can correct the cause of amblyopia, but the ophthalmologist must also treat the amblyopia itself.

9.3.2. Astigmatism

Astigmatism occurs when the front surface of your eye (cornea) or the lens inside the eye is slightly irregular in shape, resulting in vision being blurred at all distances. Astigmatism is not a disease, but is actually a vision condition that is quite common.

Causes of astigmatism

- When the front of your eye or the lens inside the eye is more oval than round, light does not focus properly on the back of your eye (retina).
- The causes of this irregular shape are unclear.
- In some cases, it may be hereditary or it may result from such factors as pressure of the eyelids on the cornea.

How common is astigmatism?
Most people have some degree of astigmatism. However, only moderate to highly astigmatic eyes may need corrective lenses.

Signs/symptoms of astigmatism

- People with severe astigmatism will usually have blurred or distorted vision.
- Those with mild astigmatism may experience headaches, eye strain, fatigue or blurred vision at certain distances.

Diagnosis of astigmatism

A comprehensive eye examination by the ophthalmologist and optometrist will include tests for astigmatism.

Can astigmatism by corrected?

Almost all levels of astigmatism can be optically corrected with properly prescribed and fitted eyeglasses or contact lenses.

Does astigmatism get progressively worse?

Astigmatism may increase slowly. Regular optometric care can, however, help to insure that proper vision is maintained.

Self-Assessment Exercises 1.

1. ---------- occurs when one eye is out of focus because it is more near sighted, farsighted or astigmatic than the other.
2. People with severe astigmatism will usually have ----------

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

How do astigmatism affect lifestyle?

You may have to adjust to wearing eyeglasses or contact lenses if you do not wear them now. Other than that, astigmatism probably will not significantly affect your lifestyle at all.

9.3.3 Cataract

Opacification of the lens of the eye (cataract) is the commonest cause of treatable blindness in the world. The large majority of cataracts occur in older age as a result of the cumulative exposure to environmental and other influences such as smoking, UV radiation and elevated blood sugar levels. This is sometimes referred to as age-related cataract. A smaller number are associated with specific ocular or systemic disease and defined physico-chemical mechanisms. Some are congenital and may be inherited.

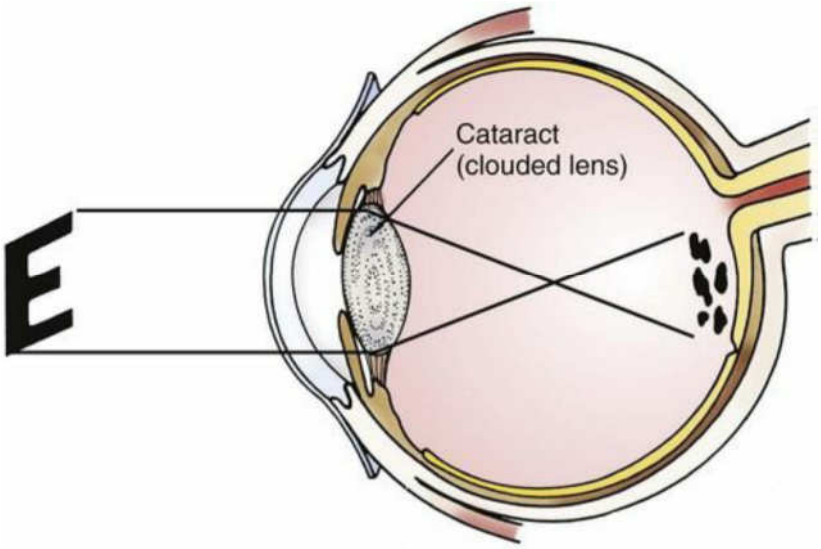

Figure 11: The visual impairment produced by the presence of a cataract.

Ocular conditions associated with cataract

- Trauma
- Uveitis
- High myopia
- Topical medication (particularly steroid eye drops)
- Intraocular tumour

Causes of cataract.

- Diabetes
- Other metabolic disorders (including galactosaemia, Fabry's disease, hypocalcaemia)
- Systemic drugs (particularly steroids, chlorpromazine)
- Infection (congenital rubella)
- Myotonic dystrophy
- Atopic dermatitis
- Systemic syndromes (Down's, Lowe's)
- Congenital, including inherited, cataract
- X-radiation
- Family history
- injury to the eye;
- medications, especially steroids;
- long-term, unprotected exposure to sunlight;
- previous eye surgery;
- Unknown factors.

Symptoms

- An opacity in the lens of the eye:
- Causes a painless loss/blurring of vision;
- Causes glare or light sensitivity;

- needing brighter light to read;
- double vision in one eye;
- poor night vision;
- May change refractive error
- Fading or yellowing of colours.

In infants, cataract may cause amblyopia (a failure of normal visual development) because the retina is deprived of a formed image. Infants with suspected cataract or a family history of congenital cataracts should be seen as a matter of urgency by an ophthalmologist

Signs

- Visual acuity is reduced.
- In some patients the acuity measured in a dark room may seem satisfactory, whereas if the same test is carried out in bright light or sunlight the acuity will be seen to fall, as a result of glare and loss of contrast.
- The cataract appears black against the red reflex when the eye is examined with a direct ophthalmoscope.
- Slit lamp examination allows the cataract to be examined in detail and the exact site of the opacity can be identified.
- Age-related cataract is commonly nuclear, cortical or subcapsular in location.
- Steroid-induced cataract is commonly posterior subcapsular.
- Other features to suggest an ocular cause for the cataract may be found, for example pigment deposition on the lens suggesting previous inflammation or damage to the iris suggesting previous ocular trauma

Investigation

- This is seldom required unless a suspected systemic disease requires exclusion or the cataract appears to have occurred at an early age.
- A thorough eye examination by the Ophthalmologist can detect the presence of a cataract, as well as any other conditions that may be causing blurred vision or other eye problems.
- Problems with other parts of the eye (e.g., cornea, retina, optic nerve) can be responsible for vision loss and may prevent you from having much or any improvement in vision after cataract surgery.
- If improvement in your vision is unlikely, cataract removal may not be recommended.

Treatment

- Although much effort has been directed towards slowing progression or preventing cataract, management remains surgical.
- There is no need to wait for the cataract to ‘ripen’.
- The test is whether or not the cataract produces sufficient visual symptoms to reduce the quality of life.

- Patients may have difficulty in recognizing faces, reading or achieving the driving standard.
- Some patients may be greatly troubled by glare.
- Patients are informed of their visual prognosis and must also be informed of any coexisting eye disease which may influence the outcome of cataract surgery.
- Protection from excessive sunlight may help slow the progression of cataracts.
- Sunglasses that screen out ultraviolet (UV) light rays or regular eyeglasses with a clear, anti-UV coating offer this protection.
- There are no medications, dietary supplements or exercises that have been shown to prevent or cure cataracts.

Self-Assessment Exercises 2.

1. Which group of drugs is particularly associated with cataract development?

2. A person with diabetes might develop what kind of cataract beginning with the letter ‘m’?
Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

When should surgery be done?

1. Surgery should be considered when cataracts cause enough loss of vision to interfere with your daily activities.
2. It is not true that cataracts need to be "ripe" before they can be removed, or that they need to be removed just because they are present.
3. Cataract surgery can be performed when visual needs require it.
4. Based on the symptoms, the patient and the ophthalmologist should decide together when surgery is appropriate.
5. Cataract surgery is a highly successful procedure. Improved vision is the result in over 95% of cases, unless there is a problem with the cornea, retina, optic nerve or other structures. It is important to understand that complications can occur during or after the surgery, some severe enough to limit vision.

Complications of cataract surgery

- Vitreous loss.
- If the posterior capsule is damaged during the operation the vitreous gel may come forward into the anterior chamber where it represents a risk of glaucoma or traction on the retina.
- It requires removal with an instrument which aspirates and excises the gel (vitrectomy).
- In these circumstances it may not be possible to place an intraocular lens in the eye immediately. Iris prolapse.
- The iris may protrude through the surgical incision in the immediate postoperative period. It appears as a dark area at the incision site.

- The pupil is distorted. This requires prompt surgical repair.
- Endophthalmitis. A serious but rare infective complication of cataract extraction (less than 0.3%).

9.5 Summary

This unit has examined the middle layer coat of the eye. It also considered the common ailments which includes astigmatism, strabismus, amblyopia and cataracts.

9.6 References/Further Readings/Web Sources

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9.7 Answers to Self-Assessment Exercises

Self-Assessment Exercises 1:

1. Amblyopia
2. Blurred or distorted vision.

Self-Assessment Exercises 2:

1. Topical medication (particularly steroid eye drops)
2. Metabolic cataracts

Unit 10: Common Ailments Related to the Middle Layer

10.1 Introduction

This unit will examine some common disorders and diseases of the inner layer of the eye. It is worth mentioning here that this is where real action of sight takes place. Some of the structures involved include retina, aqueous humour and macula.
The diseases include: diabetic retinopathy, macular oedema and glaucoma.

10.2 Learning Outcomes

At the end of this unit, the learner will be able to:

- Describe the stages of diabetic retinopathy and management
- Describe macula oedema and glaucoma
- Enumerate the expected roles of a non-eye care specialists in the care of these diseases

10.3 Main Content: Overview of the Inner Eye

The inner layer of the eye-wall is the retina. If you compare it again with a camera, the retina is the shield on which the images are projected. Millions of cells are on it, which are sensible to the light. Everything they sense, they transmit to the optic nerve.
The retina has got two types of cells. The rods are especially on the side of the retina. They are only sensitive to light and darkness. The cones are more in the centre. They are more sensitive to colours. People have about one million rods and seven million cones.
Exactly behind the pupil is the most sensitive spot of the retina: the yellow spot. There are only cones. At that spot in the eye we can see the colours very well and the sight is quite clearly. From the rods and cones the nerve-fibres leave. They join at the end of the eye, in the big optic nerve. At that spot there aren't any rods or cones. There the retina is insensitive to light and darkness. That's why that spot is called the blind spot.

10.3.2 Diabetic Retinopathy

Diabetic retinopathy is a complication of diabetes and a leading cause of blindness. It occurs when diabetes damages the tiny blood vessels inside the retina, the light sensitive

tissue at the back of the eye. A healthy retina is necessary for good vision. A person with diabetic retinopathy at first may notice no changes to his/her vision. But over time, diabetic retinopathy can get worse and cause vision loss.
Diabetic retinopathy usually affects both eyes.

Stages of diabetic retinopathy

Diabetic retinopathy has four stages:
1. Mild Non-proliferative Retinopathy. At this earliest stage, micro-aneurysms occur. They are small areas of balloon-like swelling in the retina's tiny blood vessels.
2. Moderate Non-proliferative Retinopathy. As the disease progresses, some blood vessels that nourish the retina are blocked.
3. Severe Non-proliferative Retinopathy. Many more blood vessels are blocked, depriving several areas of the retina with their blood supply. These areas of the retina send signals to the body to grow new blood vessels for nourishment.
4. Proliferative Retinopathy. At this advanced stage, the signals sent by the retina for nourishment trigger the growth of new blood vessels. This condition is called proliferative retinopathy. These new blood vessels are abnormal and fragile. They grow along the retina and along the surface of the clear, vitreous gel that fills the inside of the eye.
By themselves, these blood vessels do not cause symptoms or vision loss. However, they have thin, fragile walls. If they leak blood, severe vision loss and even blindness can result.

Who is at risk for diabetic retinopathy?

Let us now examine those who are at risk of diabetic retinopathy.

- All people with diabetes--both type 1 and type 2-are at risk. That's why everyone with diabetes should get a comprehensive dilated eye exam at least once a year.
- Between 40 to 45 percent of persons diagnosed with diabetes have some stage of diabetic retinopathy.
- During pregnancy, diabetic retinopathy may be a problem for women with diabetes. To protect vision, every pregnant woman with diabetes should have a comprehensive dilated eye exam as soon as possible.

How does diabetic retinopathy cause vision loss?

Blood vessels damaged from diabetic retinopathy can cause vision loss in two ways:
1. Fragile, abnormal blood vessels can develop and leak blood into the centre of the eye, blurring vision. This is proliferative retinopathy and is the fourth and most advanced stage of the disease.
2. Fluid can leak into the centre of the macula, the part of the eye where sharp, straight-ahead vision occurs. The fluid makes the macula swell, blurring vision. This condition is called macular oedema. It can occur at any stage of diabetic retinopathy, although it is more likely to occur as the disease progresses. About half of the people with proliferative retinopathy also have macular oedema.

Does diabetic retinopathy have any symptoms?

You may wish to ask against all these background do diabetic retinopathy has no early warning signs? Please don't wait for signs and symptoms. Encourage your clients to have a comprehensive dilated eye exam at least once a year.

Diagnosis of macular oedema and diabetic retinopathy

Macular oedema and diabetic retinopathy are detected during a comprehensive eye exam that includes:

- Visual acuity test. This eye chart test measures how well you see at various distances.
- Dilated eye exam. Drops are placed in your eyes to widen, or dilate, the pupils. Your eye care professional uses a special magnifying lens to examine your retina and optic nerve for signs of damage and other eye problems. After the exam, your close-up vision may remain blurred for several hours.
- Tonometry. An instrument measures the pressure inside the eye. Numbing drops may be applied to your eye for this test.

Eye care professional checks your retina for early signs of the disease, including:

- Leaking blood vessels.
- Retinal swelling (macular oedema).
- Pale, fatty deposits on the retina--signs of leaking blood vessels.
- Damaged nerve tissue.
- Any changes to the blood vessels.

If your eye care professional believes you need treatment for macular oedema, injected into your arm. Pictures are taken as the dye passes through the blood vessels in your retina. The test allows your eye care professional to identify any leaking blood vessels and recommend treatment.

Treatment of diabetic retinopathy

- During the first three stages of diabetic retinopathy, no treatment is needed, unless you have macular oedema.
- To prevent progression of diabetic retinopathy, people with diabetes should control their levels of blood sugar, blood pressure, and blood cholesterol.
- Proliferative retinopathy is treated with laser surgery. This procedure is called scatter laser treatment. Scatter laser treatment helps to shrink the abnormal blood vessels. The Eye doctor places 1,000 to 2,000 laser burns in the areas of the retina away from the macula, causing the abnormal blood vessels to shrink. Because a high number of laser burns are necessary, two or more sessions usually are required to complete treatment. Although the patient may notice some loss of your side vision, scatter laser treatment can save the rest of his/her sight. Scatter laser treatment may slightly reduce your colour vision and night vision.

- Scatter laser treatment works better before the fragile, new blood vessels have started to bleed. That is why it is important to have regular, comprehensive dilated eye exams. Even if bleeding has started, scatter laser treatment may still be possible, depending on the amount of bleeding. If the bleeding is severe, there may be a need for a surgical procedure called a vitrectomy. During a vitrectomy, blood is removed from the centre of the eye.

10.3.3 Macular oedema

Macular oedema is swelling of the retina at the back of the eye in the macular area usually due to fluid build-up from leakage of damaged or abnormal blood vessels. Macular oedema can occur in common retinal diseases such as wet macular degeneration, diabetic retinopathy, retinal vein occlusion and also in rare conditions such as retinal dystrophies. It can also occur as a result of inflammation following eye surgery, trauma or inflammatory conditions of the retina.

Symptoms of Macular oedema

- Macular oedema is an often painless condition that has very few symptoms.
- The macular oedema symptoms that are most often observed include blurred or distorted central vision and differences in colours, such as fading.

Investigations

- Macular oedema can be detected or suspected by an optometrist or ophthalmologist by an internal examination of the eye using eye drops to dilate the pupil and a machine called a slit lamp to look at the back of the eye.
- It is then confirmed using an OCT scan which can show up the swollen area of the macula at the back of the eye and can also provide a measurement of how abnormally thickened the macula is.
- Macular oedema can cause the macula to swell up to over 500 microns in thickness.

Treatment of macular oedema

- The treatment of macular oedema depends on the cause and may involve regular but quite painless injections of drugs into the eye. The drug that is used depends on which underlying condition is causing it.
- Macular oedema is treated with laser surgery. This procedure is called focal laser treatment. The ophthalmologist places up to several hundred small laser burns in the areas of retinal leakage surrounding the macula. These burns slow the leakage of fluid and reduce the amount of fluid in the retina. The surgery is usually completed in one session.

Further treatment may be needed.

- A patient may need focal laser surgery more than once to control the leaking fluid.

- If macular oedema is observed in both eyes and require laser surgery, generally only one eye will be treated at a time, usually several weeks apart. Focal laser treatment stabilizes vision. In fact, focal laser treatment reduces the risk of vision loss by 50 percent. In a small number of cases, if vision is lost, it can be improved. Quickly refer such person to the eye care professional if there is vision loss.

Self-Assessment Exercises 1:

1. The retina has two types of cells: List these cells and state their location and roles.
2. State the stages of diabetic retinopathy and explain the manifestation of each of them.

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

10.3.4 Glaucoma

Glaucoma is a group of conditions that can cause permanent sight loss it is characterized by:
1. Increase intra-ocular pressure (IOP) and consequences of elevated pressure
2. Optic nerve atrophy as a result of damage to the optic nerve head that may or may not be the result of a rise in the intra-ocular pressure
3. Peripheral visual field loss

Different Types of Glaucoma

The two main types of glaucoma are open angle glaucoma, or primary open angle glaucoma (POAG), and angle closure glaucoma. Others are:

- Secondary Glaucoma,
- Normal Tension Glaucoma (NTG) and Pigmentary Glaucoma

Primary Open Angle Glaucoma

This is the most common form of glaucoma, affecting about three million Americans. It happens when the eye's drainage canals become clogged over time.
The inner eye pressure (also called intraocular pressure or IOP) rises because the correct amount of fluid can't drain out of the eye. With open angle glaucoma, the entrances to the drainage canals are clear and should be working correctly. The clogging problem occurs inside the drainage canals, like the clogging that can occur inside the pipe below the drain in a sink.
Most people have no symptoms and no early warning signs. If open angle glaucoma is not diagnosed and treated, it can cause a gradual loss of vision. This type of glaucoma develops slowly and sometimes without noticeable sight loss for many years. It usually responds well to medication, especially if caught early and treated.

Angle Closure Glaucoma

This type of glaucoma is also known as acute glaucoma or narrow angle glaucoma. It is much rarer and is very different from open angle glaucoma in that the eye pressure usually goes up very fast. This happens when the drainage canals get blocked or covered over, like the clog in a sink when something is covering the drain. With angle closure glaucoma, the iris and cornea is not as wide and open as it should be. The outer edge of the iris bunches up over the drainage canals, when the pupil enlarges too much or too quickly. This can happen when entering a dark room.
A simple test can be used to see if your angle is normal and wide or abnormal and narrow. Treatment of angle closure glaucoma usually involves surgery to remove a small portion of the outer edge of the iris. This helps unblock the drainage canals so that the extra fluid can drain. Usually surgery is successful and long lasting.
However, you should still receive regular check-ups. Symptoms of angle closure glaucoma may include headaches, eye pain, nausea, rainbows around lights at night, and very blurred vision.

Secondary glaucoma

Glaucoma can occur as the result of an eye injury, inflammation, and tumour or in advanced cases of cataract or diabetes. It can also be caused by certain drugs such as steroids. This form of glaucoma may be mild or severe. The type of treatment will depend on whether it is open angle or angle closure glaucoma. Increased IOP results from other ocular or systemic condition that may block the outflow channels in some way. Secondary glaucoma may be associated with various inflammatory process that produce cells that can block the outflow channels.

Congenital glaucoma

This is abnormal formation of the angle iris and trabecular channels resulting in poor aqueous draining which causes increase IOP. If the abnormalities are severe and occur early in utero, angle glaucomatous damage may already be significant at time of birth.

Normal Tension Glaucoma (NTG)

Normal tension glaucoma is also known as low tension glaucoma or normal pressure glaucoma. In this type of glaucoma, the optic nerve is damaged even though intraocular pressure (IOP) is not very high. Doctors do not know why some people’s optic nerves are damaged even though they have what is considered to be "normal" (between 12-22 mm Hg) pressure levels.
Those at higher risk for this form of glaucoma are people with a family history of normal tension glaucoma, people of Japanese ancestry, and people with a history of systemic heart disease, such as irregular heart rhythm. Normal tension glaucoma is usually detected after an examination of the optic nerve.
The Glaucoma Research Foundation sponsored an international study to help determine the best treatment for this type of glaucoma (Collaborative NTG Study).

The study concluded eye drops that lower IOP were effective even in cases of normal tension glaucoma. Currently, most doctors treat normal tension glaucoma by keeping normal eye pressures as low as possible with medicines, laser surgery, or filtering surgery

Aetiology and pathophysiology
Risk factors for glaucoma include:

- Elevated intraocular pressure
- Family history of glaucoma
- African-American or Hispanic ancestry • Diabetes
- Myopia
- Trauma to the eye.

Glaucoma falls roughly into four classifications: The axons of retinal ganglion cells travel through the optic nerve carrying images from the eye to the brain, damage to these axons causes ganglion cell death with resultant optic nerve atrophy and patchy visual loss. The aetiology of glaucoma deals primarily with the consequences of elevated IOP. A proper balance between the rate of aqueous production (referred to as inflow) and the rate of reabsorption (outflow) is essential to maintain the IOP within normal limits. Intraocular pressure between 10-21mmHg is considered normal intraocular tenxol. This range of IOP generally results in uniform ocular health and well-being. When the rate of inflow is greater than the rate of outflow, IOP remains elevated, permanent visual damage may begin.
In open-angle glaucoma, IOP is elevated because outflow is inadequate despite an angle that appears unobstructed. In angle-closure glaucoma, IOP is elevated when a physical distortion of the peripheral iris mechanically blocks outflow.
An acute attack may be as a result of situation during which the pupil remains in a mid-dilated state long enough to cause an acute rise in IOP.
Causes may be:

- Drug-induce mydreasis – either topical or systemic medication
- Emotional excitement
- Darkness

The nurse should check drug documentation before administering medication to patient with angle-closure glaucoma and should instruct the patient not to take any mydiatic producing medication.

Clinical manifestation

POAG: Develops slowly without symptoms. The patient with POAG reports no symptoms of pain or pressure.
The patient does not notice the gradual visual field loss until peripheral vision has been severely compromised.
If untreated, patient has tunnel vision in which only a small centre field can be seen and peripheral vision is absent.

Acute angle-closure glaucoma

- Sudden excruciating pain in or around the eye
- Accompanied by nausea and vomiting
- Visual symptoms include seeing coloured halos around lights, blurred vision and ocular redness.
- Acute rise in IOP, may cause corneal oedema giving the cornea a frosted appearance.

Diagnostic studies

- Visual acuity measurement
- Tonometry
- Ophthalmoscopy (direct and indirect)
- Slit lamp microscopy
- Gonioscopy allows better visualization of anterior chamber angle
- Visual field perimetry
- Fundus photography

The glaucoma comprise a group of diseases in which damage to the optic nerve (optic neuropathy) is usually caused by the effects of raised ocular pressure acting at the optic nerve head. Independent ischemia of the optic nerve head may also be important. Axon loss results in visual field defects and a loss of visual acuity if the central visual field is involved.

Classification of glaucoma

The mechanism by which absorption is reduced provides a means of classifying the glaucoma.

Primary glaucoma	• Chronic open angle or chronic glaucoma • Acute and chronic closed angle
Congenital glaucoma	• Primary • Rubella • Secondary to other inherited ocular disorders (e.g. aniridia—absence of the iris)
Secondary glaucoma (causes)	• Trauma • Ocular surgery • Associated with other ocular disease (e.g. uveitis) • Raised episcleral venous pressure • Steroid induced

Glaucoma falls roughly into four classifications.

1. Open-angle or chronic glaucoma. This condition is thought to arise from a progressive outflow obstruction in the trabecular meshwork of the anterior chamber angle structures, with a rise in intraocular pressure. It is insidious and symptomless, initially causing erosion of the peripheral visual field. Most glaucoma falls into this group.

2. Primary angle-closure glaucoma. In this condition there is a sudden marked rise in the intraocular pressure (IOP) caused by mechanical obstruction of angle structures of the eye at the root of the iris. The vision is lost rapidly, the eye becomes red and the patient complains of excruciating pain.

3. Secondary glaucoma. Secondary glaucoma can be of either the open-angle or the narrow-angle type. The elevated intraocular pressure results from some specific disease within the eye, such as iritis or tumour, which interferes with aqueous flowing out of the eye. It may occur after trauma or may follow neovascularization in the anterior chamber, as occurs after diabetes.

4. Congenital or infantile glaucoma. This condition is often referred to as buphthalmos, because the infantile eyeball distends as a result of the elevated intraocular pressure and comes to resemble the eye of an ox.

Symptoms and Signs of Chronic open angle glaucoma

- Symptomless
- Raised intraocular pressure
- Visual field defect
- Cupped optic disc

Treatment

Treatment is aimed at reducing intraocular pressure. The level to which the pressure must be lowered varies from patient to patient, and is that which minimizes further glaucomatous visual loss. This requires careful monitoring in the outpatient clinic. Three modalities of treatment are available:

1. Medical treatment;
2. Laser treatment;
3. Surgical treatment.

Medical Treatment

Chronic open angle glaucoma topical adrenergic beta-blockers are the usual first line treatment (although some of the newer drugs are challenging this, offering more convenient dosing and fewer side effects, e.g. the prostaglandin analogues). They act by reducing aqueous production. Beta-selective beta-blockers, which may have fewer

systemic side effects, are available but must still be used with caution in those with respiratory disease, particularly asthma, which may be exacerbated even by the small amount of beta-blocker absorbed systemically. If intraocular pressure remains elevated the choice lies between:
Adding additional medical treatment;
Laser treatment;
Surgical drainage procedures.

Self-Assessment Exercises 2:

1. Discuss the classification of glaucoma. 2. What is normal pressure level of the eyes? Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

Laser trabeculoplasty

This involves placing a series of laser burns (50 μm wide) in the trabecular meshwork, to improve aqueous outflow. Whilst effective initially, the intraocular pressure may slowly increase. In the UK there is an increasing tendency to proceed to early drainage surgery.

Surgical Treatment

Drainage surgery (trabeculectomy) relies on the creation of a fistula between the anterior chamber and the sub-conjunctival space.
The operation is usually effective in substantially reducing intraocular pressure. It is performed increasingly early in the treatment of glaucoma.

10.4 Summary

We have examined the common diseases and disorders of the inner layer of the eye. These include diabetic retinopathy, macula oedema and glaucoma.

10.6 References/Further Readings/Web Sources

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10.7 Answers to Self-Assessment Exercises

Answers to Self-Assessment Exercises 1
1. The rods and the cons

- The rods are on the side of the retina. They are only sensitive to light and darkness.
- The cones are more in the centre. They are more sensitive to colours.

2. Diabetic retinopathy has four stages:
1. Mild Non-proliferative Retinopathy. At this earliest stage, micro-aneurysms occur. They are small areas of balloon-like swelling in the retina's tiny blood vessels.
2. Moderate Non-proliferative Retinopathy. As the disease progresses, some blood vessels that nourish the retina are blocked.
3. Severe Non-proliferative Retinopathy. Many more blood vessels are blocked, depriving several areas of the retina with their blood supply. These areas of the retina send signals to the body to grow new blood vessels for nourishment.
4. Proliferative Retinopathy. At this advanced stage, the signals sent by the retina for nourishment trigger the growth of new blood vessels. This condition is called proliferative retinopathy. These new blood vessels are abnormal and fragile. They grow along the retina and along the surface of the clear, vitreous gel that fills the inside of the eye.

Answers to Self-Assessment Exercises 2:
1. i. Open-angle or chronic glaucoma.
ii. Primary angle-closure glaucoma
iii. Primary angle-closure glaucoma
iv. Congenital or infantile glaucoma
2. The normal pressure level is between 12-22 mm Hg

Unit 11: COMMON DISEASES AND DISORDERS OF THE CORNEA

11.1 Introduction

This unit is especially dedicated to discuss the common ailments of the cornea. The cornea is the eye's outermost layer. It is the clear, dome-shaped surface that covers the front of the eye. For a sharp retinal image, the cornea must be transparent and intact. Corneal problems may be caused by irritation or infection (keratitis) with ulceration of the corneal surface, degeneration of the cornea (keratoconus), or deposits in the cornea. All corneal problems reduce visual sensory perception, and some can lead to blindness. The colour and turgor of the cornea is what makes vision possible. We shall examine its structure, how it responds to injury as well as its diseases and disorders.

11.2 Learning Outcomes

At the end of this unit, the learner will be able to:

- Clearly describe the structures of cornea
- Describe the common diseases and disorders of the cornea

11.3 The structures of Cornea

Although the cornea is clear and seems to lack substance, it is actually a highly organized group tissues in the body, the cornea contains no blood vessels to nourish or protect it against nourishment from the tears and aqueous humour that fills the chamber behind it. The cornea must properly, and the presence of even the tiniest blood vessels can interfere with this process, it must be free of any cloudy or opaque areas. The corneal tissue is arranged in five basic layers, these five layers are:

Epithelium

The epithelium is the cornea's outermost region, comprising about 10 percent of tissue's thickness. The epithelium functions primarily to:

1. Block the passage of foreign material, such as dust, water, and bacteria, into the eye and other layers of the cornea; and
2. Provide a smooth surface that absorbs oxygen and cell nutrients from tears, then distributes these nutrients to the rest of the cornea. The epithelium is filled with thousands of tiny nerve endings that make the cornea extremely sensitive to pain

when rubbed or scratched. The part of the epithelium that serves as the foundation on which the epithelial cells anchor and organize themselves is called the basement membrane.

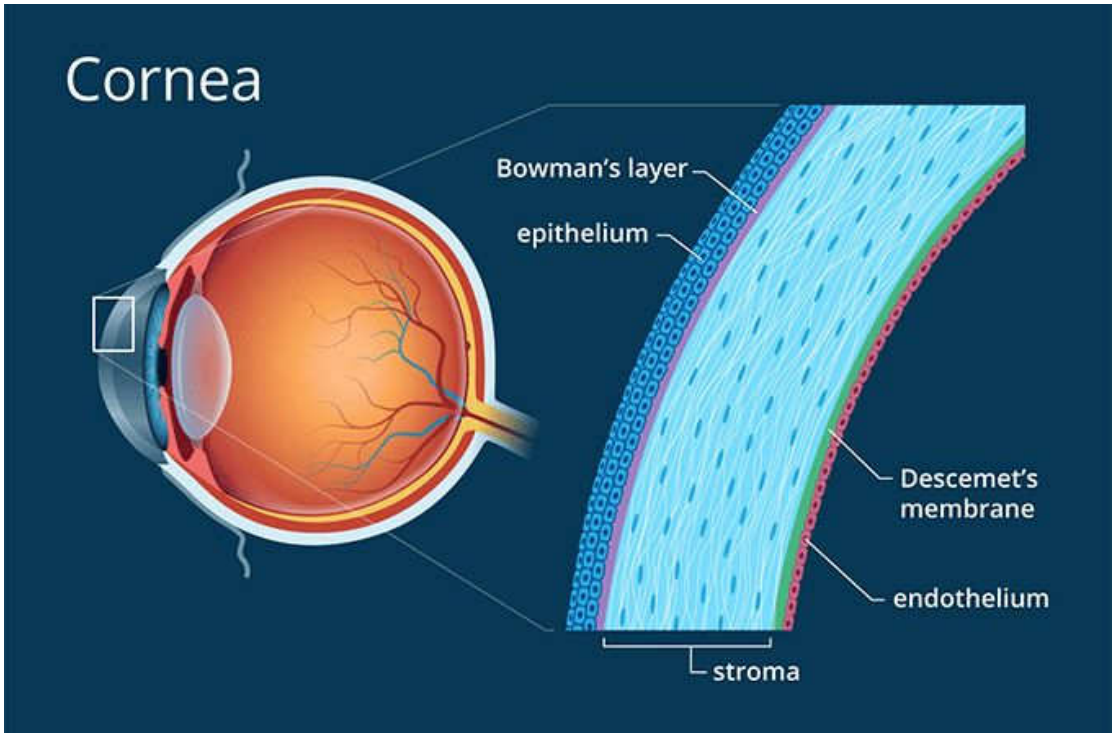

Figure 12: Structure and Layers of the cornea

Bowman's Layer

Lying directly below the basement membrane of the epithelium is a transparent sheet of tissue known as Bowman's layer. It is composed of strong layered protein fibres called collagen. Once injured, Bowman's layer can form a scar as it heals. If these scars are large and centrally located, some vision loss can occur.

Stroma

Beneath Bowman's layer is the stroma, which comprises about 90 percent of the cornea's thickness. It consists primarily of water (78 percent) and collagen (16 percent), and does not contain any blood vessels. Collagen gives the cornea its strength, elasticity, and form.
The collagen's unique shape, arrangement, and spacing are essential in producing the cornea's light-conducting transparency.

Descemet's Membrane

Under the stroma is Descemet's membrane, a thin but strong sheet of tissue that serves as a protective barrier against infection and injuries. Descemet's membrane is composed

of collagen fibres (different from those of the stroma) and is made by the endothelial cells that lie below it. Descemet's membrane is regenerated readily after injury.

Endothelium

The endothelium is the extremely thin, innermost layer of the cornea. Endothelial cells are essential in keeping the cornea clear. Normally, fluid leaks slowly from inside the eye into the middle corneal layer (stroma). The endothelium's primary task is to pump this excess fluid out of the stroma. Without this pumping action, the stroma would swell with water, become hazy, and ultimately opaque. In a healthy eye, a perfect balance is maintained between the fluid moving into the cornea and fluid being pumped out of the cornea. Once endothelium cells are destroyed by disease or trauma, they are lost forever. If too many endothelial cells are destroyed, corneal oedema and blindness ensue, with corneal transplantation the only available therapy.

11.4.1 Cornea response to injury

The cornea copes very well with minor injuries or abrasions. If the highly sensitive cornea is scratched, healthy cells slide over quickly and patch the injury before infection occurs and vision is affected. If the scratch penetrates the cornea more deeply, however, the healing process will take longer, at times resulting in greater pain, blurred vision, tearing, redness, and extreme sensitivity to light. These symptoms require professional treatment.
Deeper scratches can also cause corneal scarring, resulting in a haze on the cornea that can greatly impair vision. In this case, a corneal transplant may be needed.

11.4.2 Common diseases and disorders of the cornea

Allergies.

Allergies affecting the eye are fairly common. The most common allergies are those related to pollen, particularly when the weather is warm and dry. Symptoms can include redness, itching, tearing, burning, stinging, and watery discharge, although they are not usually severe enough to require medical attention. Antihistamine decongestant eye drops can effectively reduce these symptoms, as does rain and cooler weather, which decreases the amount of pollen in the air. An increasing number of eye allergy cases are related to medications and contact lens wear. Also, animal hair and certain cosmetics, such as mascara, face creams, and eyebrow pencil, can cause allergies that affect the eye.
Touching or rubbing eyes after handling nail polish, soaps, or chemicals may cause an allergic reaction. Some people have sensitivity to lip gloss and eye makeup. Allergy symptoms are temporary and can be eliminated by not having contact with the offending cosmetic or detergent.

Conjunctivitis (Pink Eye).

This term describes a group of diseases that cause swelling, itching, burning, and redness of eyelids and covers exposed areas of the sclera, or white of the eye. Conjunctivitis can spread from one person to another and affects large number of people at any given time.

Conjunctivitis can be caused by a bacterial or viral infection, allergy, environmental irritants, a contact lens product, eye drops, or eye ointments. At its onset, conjunctivitis is usually painless and does not adversely affect vision. The infection will clear in most cases without requiring medical care. But for some forms of conjunctivitis, treatment will be needed. If treatment is delayed, the infection may worsen and cause corneal inflammation and a loss of vision.

Corneal Infections. Sometimes the cornea is damaged after a foreign object has penetrated the tissue, such as from a poke in the eye. At other times, bacteria or fungi from a contaminated contact lens can pass into the cornea. Situations like these can cause painful inflammation and corneal infections called keratitis. These infections can reduce visual clarity, produce corneal discharges, and perhaps erode the cornea. Corneal infections can also lead to corneal scarring, corneal transplant.

As a general rule, the deeper the corneal infection, the more severe the symptoms and complications. It should be noted that corneal infections, although relatively infrequent, are the most serious complication of contact lens wear.

Minor corneal infections are commonly treated with anti-bacterial eye drops. If the problem is severe, it may require more intensive antibiotic or anti-fungal treatment to eliminate the infection, as well as steroid eye drops to reduce inflammation. Frequent visits to an eye care professional may be necessary for several months to eliminate the problem.

Dry Eye.

The continuous production and drainage of tears is important to the eye's health. Tears keep the eye moist, help wounds heal, and protect against eye infection. In people with dry eye, the eye produces fewer or less quality tears and is unable to keep its surface lubricated and comfortable.

The tear film consists of three layers--an outer, oily (lipid) layer that keeps tears from evaporating too quickly and helps tears remain on the eye; a middle (aqueous) layer that nourishes the cornea and conjunctiva; and a bottom (mucin) layer that helps to spread the aqueous layer across the eye to ensure that the eye remains wet. As we age, the eyes usually produce fewer tears. Also, in some cases, the lipid and mucin layers produced by the eye are of such poor quality that tears cannot remain in the eye long enough to keep the eye sufficiently lubricated.

The main symptom of dry eye is usually a scratchy or sandy feeling as if something is in the eye. Other symptoms may include stinging or burning of the eye; episodes of excess tearing that follow periods of very dry sensation; a stringy discharge from the eye; and pain and redness of the eye. Sometimes people with dry eye experience heaviness of the eyelids or blurred, changing, or decreased vision, although loss of vision is uncommon.

Dry eye is more common in women, especially after menopause. Surprisingly, some people with dry eye may have tears that run down their cheeks. This is because the eye may be producing less of the lipid and mucin layers of the tear film, which help keep tears in the eye. When this happens, tears do not stay in the eye long enough to thoroughly moisten it.
Dry eye can occur in climates with dry air, as well as with the use of some drugs, including antihistamines, nasal decongestants, tranquilizers, and anti-depressant drugs. People with dry eye should let their health care providers know all the medications they are taking, since some of them may intensify dry eye symptoms.
People with connective tissue diseases, such as rheumatoid arthritis, can also develop dry eye. It is important to note that dry eye is sometimes a symptom of Sjögren's syndrome, a disease that attacks the body's lubricating glands, such as the tear and salivary glands. A complete physical examination may diagnose any underlying diseases.
Artificial tears, which lubricate the eye, are the principal treatment for dry eye. Sterile ointments are sometimes used at night to help prevent the eye from drying. Using humidifiers, wearing wrap-around glasses when outside, and avoiding outside windy and dry conditions may bring relief. For people with severe cases of dry eye, temporary or permanent closure of the tear drain (small openings at the inner corner of the eyelids where tears drain from the eye) may be helpful.

Fuchs' Dystrophy.

Fuchs' dystrophy is a slowly progressing disease that usually affects both eyes and is slightly more common in women than in men. Although doctors can often see early signs of Fuchs' dystrophy in people in their 30s and 40s, the disease rarely affects vision until people reach their 50s and 60s.
Fuchs' dystrophy occurs when endothelial cells gradually deteriorate without any apparent reason. As more endothelial cells are lost over the years, the endothelium becomes less efficient at pumping water out of the stroma. This causes the cornea to swell and distort vision. Eventually, the epithelium also takes on water, resulting in pain and severe visual impairment.
Epithelial swelling damages vision by changing the cornea's normal curvature, and causing a sight-impairing haze to appear in the tissue. Epithelial swelling will also produce tiny blisters on the corneal surface. When these blisters burst, they are extremely painful.
At first, a person with Fuchs' dystrophy will awaken with blurred vision that will gradually clear during the day. This occurs because the cornea is normally thicker in the morning; it retains fluids during sleep that evaporate in the tear film while we are awake.
As the disease worsens, this swelling will remain constant and reduce vision throughout the day.
When treating the disease, doctors will try first to reduce the swelling with drops, ointments, or soft contact lenses. They may also instruct a person to use a hair dryer, held at arm's length or directed across the face, to dry out the epithelial blisters. This can be done two or three times a day.

When the disease interferes with daily activities, a person may need to consider having a corneal transplant to restore sight. The short-term success rate of corneal transplantation is quite good for people with Fuchs' dystrophy. However, some studies suggest that the long-term survival of the new cornea can be a problem.

Herpes Zoster (Shingles).

This infection is produced by the varicella-zoster virus, the same virus that causes chickenpox. After an initial outbreak of chickenpox (often during childhood), the virus remains inactive within the nerve cells of the central nervous system. But in some people, the varicella-zoster virus will reactivate at another time in their lives. When this occurs, the virus travels down long nerve fibres and infects some part of the body, producing a blistering rash (shingles), fever, painful inflammations of the affected nerve fibres, and a general feeling of sluggishness.

Varicella-zoster virus may travel to the head and neck, perhaps involving an eye, part of the nose, cheek, and forehead. In about 40 percent of those with shingles in these areas, the virus infects the cornea. Doctors will often prescribe oral anti-viral treatment to reduce the risk of the virus infecting cells deep within the tissue, which could inflame and scar the cornea. The disease may also cause decreased corneal sensitivity, meaning that foreign matter, such as eyelashes, in the eye are not felt as keenly. For many, this decreased sensitivity will be permanent.

Although shingles can occur in anyone exposed to the varicella-zoster virus, research has established two general risk factors for the disease:

(1) Advanced age; and

(2) A weakened immune system. Studies show that people over age 80 have a five times greater chance of having shingles than adults between the ages of 20 and 40. Unlike Herpes Simplex I, the varicella-zoster virus does not usually flare up more than once in adults with normally functioning immune systems. Be aware that corneal problems may arise months after the shingles are gone. For this reason, it is important that people who have had facial shingles schedule follow-up eye examinations.

Iridocorneal Endothelial Syndrome. More common in women and usually diagnosed between ages 30-50, iridocorneal endothelial (ICE) syndrome has three main features:

(1) Visible changes in the iris, the colour part of the eye that regulates the amount of light entering the eye;

(2) Swelling of the cornea; and

(3) The development of glaucoma, a disease that can cause severe vision loss when normal fluid inside the eye cannot drain properly. ICE is usually present in only one eye.

ICE syndrome is actually a grouping of three closely linked conditions: iris nevus (or Cogan-Reese) syndrome; Chandler's syndrome; and essential (progressive) iris atrophy (hence the acronym ICE). The most common feature of this group of diseases is the movement of endothelial cells off the cornea onto the iris. This loss of cells from the cornea often leads to corneal swelling, distortion of the iris, and variable degrees of distortion of the pupil, the adjustable opening at the centre of the iris that allows varying amounts of light to enter the eye. This cell movement also plugs the fluid outflow channels of the eye, causing glaucoma.

The cause of this disease is unknown. While we do not yet know how to keep ICE syndrome from progressing, the glaucoma associated with the disease can be treated with medication, and a corneal transplant can treat the corneal swelling.

Keratoconus.

This disorder--a progressive thinning of the cornea--is the most common corneal dystrophy in the U.S., affecting one in every 2000 Americans. It is more prevalent in teenagers and adults in their 20s. Keratoconus arises when the middle of the cornea thins and gradually bulges outward, forming a rounded cone shape. This abnormal curvature changes the cornea's refractive power, producing moderate to severe distortion (astigmatism) and blurriness (near-sightedness) of vision. Keratoconus may also cause swelling and a sight-impairing scarring of the tissue.
Studies indicate that keratoconus stems from one of several possible causes:

- An inherited corneal abnormality. About seven percent of those with the condition have a family history of keratoconus.
- An eye injury, i.e., excessive eye rubbing or wearing hard contact lenses for many years.
- Certain eye diseases, such as retinitis pigmentosa, retinopathy of prematurity, and vernal kerato-conjunctivitis.
- Systemic diseases, such as Leber's congenital amaurosis, Ehlers-Danlos syndrome, Down syndrome, and osteogenesis imperfecta.

Keratoconus usually affects both eyes. At first, people can correct their vision with eyeglasses. But as the astigmatism worsens, they must rely on specially fitted contact lenses to reduce the distortion and provide better vision. Although finding a comfortable contact lens can be an extremely frustrating and difficult process, it is crucial because a poorly fitting lens could further damage the cornea and make wearing a contact lens intolerable.

In most cases, the cornea will stabilize after a few years without ever causing severe vision problems. But in about 10 to 20 percent of people with keratoconus, the cornea will eventually become too scarred or will not tolerate a contact lens. If either of these problems occur, a corneal transplant may be needed. This operation is successful in more than 90 percent of those with advanced keratoconus. Several studies have also reported that 80 percent or more of these patients have 20/40 vision or better after the operation.
The National Eye Institute is conducting a natural history study--called the Collaborative Longitudinal Evaluation of Keratoconus Study--to identify factors that influence the severity and progression of keratoconus. These includes:

Lattice Dystrophy.

Lattice dystrophy gets its name from an accumulation of amyloid deposits, or abnormal protein fibres, throughout the middle and anterior stroma. During an eye examination, the doctor sees these deposits in the stroma as clear, comma-shaped overlapping dots

and branching filaments, creating a lattice effect. Over time, the lattice lines will grow opaque and involve more of the stroma. They will also gradually converge, giving the cornea a cloudiness that may also reduce vision.
In some people, these abnormal protein fibres can accumulate under the cornea's outer layer--the epithelium. This can cause erosion of the epithelium. This condition is known as recurrent epithelial erosion. These erosions alter the cornea's normal curvature, resulting in temporary vision problems; and expose the nerves that line the cornea, causing severe pain. Even the involuntary act of blinking can be painful.
To ease this pain, an eye doctor may prescribe eye drops and ointments to reduce the friction on the eroded cornea. In some cases, an eye patch may be used to immobilize the eyelids. With effective care, these erosions usually heal within three days, although occasional sensations of pain may occur for the next 6 to 8 eight weeks.
By about age 40, some people with lattice dystrophy will have scarring under the epithelium, resulting in a haze on the cornea that can greatly obscure vision. In this case, a corneal transplant may be needed. Although people with lattice dystrophy have an excellent chance for a successful transplant, the disease may also arise in the donor cornea in as little as three years. In one study, about half of the transplant patients with lattice dystrophy had a recurrence of the disease from between two to 26 years after the operation. Of these, 15 percent required a second corneal transplant. Early lattice and recurrent lattice arising in the donor cornea responds well to treatment with the excimer laser.
Although lattice dystrophy can occur at any time in life, the condition usually arises in children between the ages of 2 and 7.

Map-Dot-Fingerprint Dystrophy.

This dystrophy occurs when the epithelium's basement membrane develops abnormally (the basement membrane serves as the foundation on which the epithelial cells, which absorb nutrients from tears, anchor and organize themselves). When the basement membrane develops abnormally, the epithelial cells cannot properly adhere to it. This, in turn, causes recurrent epithelial erosions, in which the epithelium's outermost layer rises slightly, exposing a small gap between the outermost layer and the rest of the cornea.
Epithelial erosions can be a chronic problem. They may alter the cornea's normal curvature, causing periodic blurred vision. They may also expose the nerve endings that line the tissue, resulting in moderate to severe pain lasting as long as several days. Generally, the pain will be worse on awakening in the morning.
Other symptoms include sensitivity to light, excessive tearing, and foreign body sensation in the eye.
Map-dot-fingerprint dystrophy, which tends to occur in both eyes, usually affects adults between the ages of 40 and 70, although it can develop earlier in life. Also known as epithelial basement membrane dystrophy, map-dot-fingerprint dystrophy gets its name from the unusual appearance of the cornea during an eye examination. Most often, the affected epithelium will have a map-like appearance, i.e., large, slightly gray outlines that look like a continent on a map. There may also be clusters of opaque dots underneath or close to the maplike patches. Less frequently, the irregular basement

membrane will form concentric lines in the central cornea that resemble small fingerprints.
Typically, map-dot-fingerprint dystrophy will flare up occasionally for a few years and then go away on its own, with no lasting loss of vision. Most people never know that they have map-dot-fingerprint dystrophy, since they do not have any pain or vision loss. However, if treatment is needed, eye doctors will try to control the pain associated with the epithelial erosions. They may patch the eye to immobilize it, or prescribe lubricating eye drops and ointments. With treatment, these erosions usually heal within three days, although periodic flashes of pain may occur for several weeks thereafter. Other treatments include anterior corneal punctures to allow better adherence of cells; corneal scraping to remove eroded areas of the cornea and allow regeneration of healthy epithelial tissue; and use of the excimer laser to remove surface irregularities.

Ocular Herpes.

Herpes of the eye, or ocular herpes, is a recurrent viral infection that is caused by the herpes simplex virus and is the most common infectious cause of corneal blindness in the U.S. Previous studies show that once people develop ocular herpes, they have up to a 50 percent chance of having a recurrence. This second flare-up could come weeks or even years after the initial occurrence.
Ocular herpes can produce a painful sore on the eyelid or surface of the eye and cause inflammation of the cornea. Prompt treatment with anti-viral drugs helps to stop the herpes virus from multiplying and destroying epithelial cells.
However, the infection may spread deeper into the cornea and develop into a more severe infection called stromal keratitis, which causes the body's immune system to attack and destroy stromal cells. Stromal keratitis is more difficult to treat than less severe ocular herpes infections. Recurrent episodes of stromal keratitis can cause scarring of the cornea, which can lead to loss of vision and possibly blindness.
Like other herpetic infections, herpes of the eye can be controlled. In one large study, researchers found that recurrence rate of ocular herpes was 10 percent within one year, 23 percent within two years, and 63 percent within 20 years.
Some factors believed to be associated with recurrence include fever, stress, sunlight, and eye injury. The National Eye Institute supported the Herpetic Eye Disease Study, a group of clinical trials that studied various treatments for severe ocular herpes.

Pterygium.

A pterygium is a pinkish, triangular-shaped tissue growth on the cornea. Some pterygia grow slowly throughout a person's life, while others stop growing after a certain point. A pterygium rarely grows so large that it begins to cover the pupil of the eye.
Pterygia are more common in sunny climates and in the 20-40 age group. Scientists do not know what causes pterygia to develop. However, since people who have pterygia usually have spent a significant time outdoors, many doctors believe ultraviolet (UV) light from the sun may be a factor. In areas where sunlight is strong, wearing protective eyeglasses, sunglasses, and/or hats with brims are suggested. While some studies report

a higher prevalence of pterygia in men than in women, this may reflect different rates of exposure to UV light.

- Because a pterygium is visible, many people want to have it removed forncosmetic reasons. It is usually not too noticeable unless it becomes red and swollen from dust or recommended unless it affects vision. If a pterygium is surgically removed, it may grow back, particularly if the patient is less than 40 years of age. Lubricants can reduce the redness and provide relief from the chronic irritation.
- Stevens - Johnson syndrome. Stevens - Johnson syndrome (SJS), also called erythema multiforme major, is a disorder of the skin that can also affect the eyes. SJS is characterized by painful, blistery lesions on the skin and the mucous membranes (the thin, moist tissues that line body cavities) of the mouth, throat, genital region, and eyelids. SJS can cause serious eye problems, such as severe conjunctivitis; iritis, an inflammation inside the eye; corneal blisters and erosions; and corneal holes. In some cases, the ocular complications from SJS can be disabling and lead to severe vision loss.

Scientists are not certain why SJS develops. The most commonly cited cause of SJS is an adverse allergic drug reaction. Almost any drug--but most particularly sulfa drugs--can cause SJS. The allergic reaction to the drug may not occur until 7-14 days after first using it. SJS can also be preceded by a viral infection, such as herpes or the mumps, and its accompanying fever, sore throat, and sluggishness. Treatment for the eye may include artificial tears, antibiotics, or corticosteroids. About one-third of all patients diagnosed with SJS have recurrences of the disease.

SJS occurs twice as often in men as women, and most cases appear in children and young adults under 30, although it can develop in people at any age

Self-Assessment Exercise 1

1. What are the primary function of the Epithelium?

2. Johnson syndrome (SJS), also called _____

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

Corneal Dystrophies

A corneal dystrophy is a condition in which one or more parts of the cornea lose their normal clarity due to a build-up of cloudy material. There are over 20 corneal dystrophies that affect all parts of the cornea. These diseases share many traits:

1) 1 They are usually inherited.
2) They affect the right and left eyes equally.
3) They are not caused by outside factors, such as injury or diet.
4) Most progress gradually. Usually begin in one of the five corneal layers and may later spread to nearby layers.

5) Most do not affect other parts of the body, nor are they related to diseases affecting other parts of the eye or body.
6) Most can occur in gradually.
7) Otherwise totally healthy people, male or female.

Corneal dystrophies affect vision in widely differing ways. Some cause severe visual impairment, while a few cause no vision problems and are discovered during a routine eye examination. Other dystrophies may cause repeated episodes of pain without leading to permanent loss of vision. Some of the most common corneal dystrophies include Fuchs' dystrophy, keratoconus, lattice dystrophy, and map-dot-fingerprint dystrophy.

Corneal transplant

A corneal transplant involves replacing a diseased or scarred cornea with a new one.
When the cornea becomes cloudy, light cannot penetrate the eye to reach the light sensitive retina. Poor vision or blindness may result.
In corneal transplant surgery, the surgeon removes the central portion of the cloudy cornea and replaces it with a clear cornea, usually donated through an eye bank. A trephine, an instrument like a cookie cutter, is used to remove the cloudy cornea. The surgeon places the new cornea in the opening and sews it with a very fine thread. The thread stays in for months or even years until the eye heals properly (removing the thread is quite simple and can easily be done in an ophthalmologist's office). Following surgery, eye drops to help promote healing will be needed for several months.
Corneal transplants are very common in the United States; about 40,000 are performed each year. The chances of success of this operation have risen dramatically because of technological advances, such as less irritating sutures, or threads, which are often finer than a human hair; and the surgical microscope. Corneal transplantation has restored sight to many, who a generation ago would have been blinded permanently by corneal injury, infection, or inherited corneal disease or degeneration

Problems that can develop from a corneal transplant

Even with a fairly high success rate, some problems can develop, such as rejection of the new cornea. Warning signs for rejection are decreased vision, increased redness of the eye, increased pain, and increased sensitivity to light. If any of these last for more than six hours, you should immediately call your ophthalmologist. Rejection can be successfully treated if medication is administered at the first sign of symptoms.
A study supported by the National Eye Institute (NEI) suggests that matching the blood type, but not tissue type, of the recipient with that of the cornea donor may improve the success rate of corneal transplants in people at high risk for graft failure.
Approximately 20 percent of corneal transplant patients--between 6000-8000 a year--reject their donor corneas. The NEI-supported study, called the Collaborative Corneal Transplantation Study, found that high-risk patients may reduce the likelihood of corneal rejection if their blood types match those of the cornea donors. The study also

concluded that intensive steroid treatment after transplant surgery improves the chances for a successful transplant.

Alternatives to a corneal transplant

Phototherapeutic keratectomy (PTK) is one of the latest advances in eye care for the treatment of corneal dystrophies, corneal scars, and certain corneal infections. Only a short time ago, people with these disorders would most likely have needed a corneal transplant. By combining the precision of the excimer laser with the control of a computer, doctors can vaporize microscopically thin layers of diseased corneal tissue and etch away the surface irregularities associated with many corneal dystrophies and scars. Surrounding areas suffer relatively little trauma. New tissue can then grow over the now-smooth surface. Recovery from the procedure takes a matter of days, rather than months as with a transplant. The return of vision can occur rapidly, especially if the cause of the problem is confined to the top layer of the cornea. Studies have shown close to an 85 percent success rate in corneal repair using PTK for well-selected patients

The Excimer Laser

One of the technologies developed to treat corneal disease is the excimer laser. This device emits pulses of ultraviolet light--a laser beam--to etch away surface irregularities of corneal tissue. Because of the laser's precision, damage to healthy, adjoining tissue is reduced or eliminated. The PTK procedure is especially useful for people with inherited disorders, whose scars or other corneal opacities limit vision by blocking the way images form on the retina. PTK has been approved by the U.S. Food and Drug Administration.

Self-Assessment Exercise 2

1 Name 5 Corneal Dystrophies that affect all parts of the corneal

2 One of the technologies developed to treat corneal disease is the excimer laser (True/ False)

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

Current Corneal Research

Vision research funded by the National Eye Institute (NEI) is leading to progress in understanding and treating corneal disease. For example, scientists are learning how transplanting corneal cells from a patient's healthy eye to the diseased eye can treat certain conditions that previously caused blindness. Vision researchers continue to investigate ways to enhance corneal healing and eliminate the corneal scarring that can threaten sight. Also, understanding how genes produce and maintain a healthy cornea will help in treating corneal disease. Genetic studies in families afflicted with corneal dystrophies have yielded new insight into 13 different corneal dystrophies, including

keratoconus. To identify factors that influence the severity and progression of keratoconus, the NEI is conducting a natural history study- -called the Collaborative Longitudinal Evaluation of Keratoconus (CLEK) Study--that is following more than 1200 patients with the disease. Scientists are looking for answers to how rapidly their keratoconus will progress, how bad their vision will become, and whether they will need corneal surgery to treat it.

11.5 Summary

This unit has considered common ailments, diseases and disorders of cornea. It is hoped that you will find it instructive in the discharge of your clinical duties at any stage of health care you find yourself. Please note that this instruction does not make you an eye care expert. However, the information is worth sharing as you may be the next and only hope of saving a person from going blind.

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11.8 Answers to Self-Assessment exercises

Answers to Self- Assessment Exercise 1:

- To block the passage of foreign material, such as dust, water, and bacteria, into the eye and other layers of the cornea
- To provide a smooth surface that absorbs oxygen and cell nutrients from tears, then distributes these nutrients to the rest of the cornea.

2. Johnson syndrome (SJS), also called _____ Erythema multiforme major

Answers to Self-Assessment Exercise 2

- They are usually inherited.
- They affect the right and left eyes equally.
- They are not caused by outside factors, such as injury or diet
- Most progress gradually. Usually begin in one of the five corneal layers and may later spread to nearby layers.
- Most do not affect other parts of the body, nor are they related to diseases affecting other parts of the eye or body.

2. One of the technologies developed to treat corneal disease is the excimer laser (True).

End of the Module Questions

Describe the signs and symptoms of conjunctivitis. What will be your immediate care for your neighbour who show signs of conjunctivitis

Module 4: Changes in the Eye

Module Structure

Unit 12: Retinal problems
Unit 13: Macular Degeneration
Unit 14: Ophthalmic puzzles
Unit 15: Cranial Nerve (CN) III Palsy
Unit 16: Effect of Ageing on the Eye
End of the Module Questions

UNIT 12: Retinal problems

12.1 Introduction

Critical to an understanding of retinal detachment (RD) is the fact that embryonic eyes develop from two optic vesicles which are derived from the embryonic forebrain. The retina and optic nerve develop from the optic cup, which folds in on itself; its outer wall develops into the retinal pigment epithelium, and the inner wall becomes the sensory layer of the retina. The retina therefore originally comprised two layers – the nervous layer and the pigment layer. Because of the nature of its embryonic development, the retina is thus an outward extension of the brain, to which it remains connected via the optic nerve.

12.2 Learning Outcomes

- By the end of this unit, learners should be able to:
- Understand how development of retinal detachment
- Identify various type of retinal detachment
- Explain the nursing care of patient who is undergoing surgery for RD

12.3 Main Content: Retinal Detachment

The retina originally consists of two layers, the nervous layer and the pigment layer, that bond together as the baby grows. A retinal detachment is actually a separation of the nervous layer from the pigment layer of the retina.

12.3.1 Rhegmatogenous retinal detachment

A rhegma is a hole. A simple hole in the retina rarely causes symptoms and may be discovered during a routine eye test. Occasionally the ophthalmologist may decide not to treat the hole, and observe it instead over a period of time. According to Ghazi and Green (2001) this is because ‘formed vitreous gel acts as a seal to retinal breaks and indirectly prevents retinal detachment’. A rhegmatogenous retinal detachment occurs when the retinal layers are detached from one another as the result of a tear, break or hole, allowing sub-retinal fluid to accumulate between the nervous and pigment layers.

Causes of rhegmatogenous retinal detachment:

Short-sightedness:

A ‘short sighted’ person has a physiologically longer eye, and as a result, the retina is stretched more tightly across the back of the eye. In the myopic eye therefore there is a greater tendency for the layers of the retina to detach as a result of a tear. The incidence of myopia varies across populations, and with family hereditary factors, but Kanski (2007) states that myopia affects 10% of the population. He goes on to say that 40% of all retinal detachments occur in myopic eyes. Highly myopic people with prescriptions ranging from –5 to –20 are at an even greater risk of developing retinal detachment. Unfortunately high myopia is an inherited tendency and may be accompanied by a

family history of retinal detachments. You can read a well-illustrated article on the subject of retinal detachments by Larkin (2006).

Cataract surgery:

The Department of Health (2008) recognises that cataract surgery (in addition to myopia) is a predisposing factor for retinal detachment. They quantify it as causing a 0.7% increased risk of retinal detachment.

Ageing:

Ageing makes a person increasingly susceptible to developing a retinal detachment. Riordan-Eva et al. (2003) state that syneresis (shrinking of the vitreous gel) affects 60% of people aged over 60. Shrinking of the vitreous is significant because it is attached to the retina at the pars plana of the ciliary body, at the optic disc and macula. As the 'shrinking vitreous' moves with rotational eye movements, sufficient 'pulling' forces may be generated to cause the retina to tear at an area where it is attached to the vitreous, for example at the optic disc margins, macula, along the main blood vessels – causing vitreous haemorrhage – and at the pars plana. Any further traction will cause the tear to increase. By the age of about 60 (Kanski, 2007) about 65% of the vitreous will have liquefied. Syneresis is the word used to describe the process by which the ageing vitreous gel contracts and fluid separates out. Photopsia is a symptom of these vitreous changes, and is described medically as flashing lights in the visual field.
Retinal tears are another cause of rhegmatogenous detachment and sometimes occur in a susceptible person in response to injury. Blunt trauma to the eye, for example from a football or a fist, may cause a retinal tear, as may a bang to the head as in an elderly person who falls.
Lattice degeneration affects 7% of the population (Riordan-Eva et al., 2003). It is a type of retinal thinning that runs around the circumference of the eye from the ora serata and sometimes leads to full-thickness retinal holes developing at the lesions. It is a feature of ageing, but may develop earlier in myopic people.

The treatments for rhegmatogenous retinal detachment are:

- laser to seal small tears
- cryothermy to lattice for small tears
- explant (plomb/encirclement)
- retinopexy insertion of gas
- silicone tamponade
- vitrectomy

Self- Assessment Exercise 1:

1. Enumerate the causes of rhegmatogenous retinal detachment. 2. Discuss the condition retinal detachment. Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

12.3.2 Macular hole

A macular hole is a tiny full-thickness retinal hole at the macula, occurring predominantly in women. It causes central visual distortion, and generally affects only one eye. If the hole is not treated it may lead to retinal detachment, but successful surgery can improve sight. Treatment is by vitrectomy, insertion of gas and posturing.

12.3.3 Tractional Retinal Detachment

A rare cause of this type of detachment is retinopathy of prematurity (ROP). This condition used to be known as retrolental fibroplasia and it is linked to premature babies and the oxygen levels they receive in neonatal incubators to keep them alive. Abnormalities occur in the developing retinal blood vessels. Laser treatment may be needed to seal them and prevent retinal detachment.

Today's treatments are effective in ensuring reasonable visual outcomes if they are carried out in time. However, if you work with adults, you may meet an older person who was born before the need to check the retinas of premature babies was understood, and before laser treatment was available. There is no cure at this stage. They may comment when you go to test their eyes that their poor vision is due to prematurity and being nursed in an incubator with high oxygen levels.

Diabetic retinopathy may also cause a tractional retinal detachment. This is due to problems with the micro vascular circulation of the retina. High blood sugar levels and raised blood pressure eventually lead to thickening and blockage of the microcirculation. Resultant damage to the basement membrane of the retina causes release of VEGF (vascular endothelial growth factor). This stimulates the growth of new, immature blood vessels growing forward from the retina into the vitreous.

12.3.4 Exudative retinal detachment

Exudative detachments are very rare. They arise from fluid accumulating under the retina due to tumours and inflammation.

Treatment is directed to the underlying cause.

12.4 Nursing management of a patient with retinal detachment

If a patient is booked into an ophthalmic accident and emergency department with suspected retinal detachment, ophthalmic nurses or professionals allied to medicine (PAMs) would generally be expected to obtain and accurately document:

- A history of the patient's presenting ocular/visual symptoms.
- A history of the patient's past ocular diseases and conditions.
- A family history of eye problems.
- A relevant social history including occupation.
- A summary of the patient's current past and current general health.
- A history of current medications for ocular and general health.
- A history of any allergies/adverse reactions to treatments.
- A note of any areas of particular concern.

They would also:

- Test and accurately record visual acuity
- Measure and record intraocular pressure
- Make a preliminary slit lamp examination of the anterior chamber
- Check for a relative afferent pupil defect
- Check for red reflex.

12.4.1 Preoperative Care

- The patient is usually anxious and fearful about a possible permanent loss of vision. Nursing priorities include providing information and reassurance to allay fears.
- Instruct the patient to restrict activity and head movement before surgery to prevent further tearing or detachment.
- An eye patch is placed over the affected eye to reduce eye movement.
- Topical drugs are given before surgery to inhibit pupil constriction and accommodation.

12.4.2 Operative Procedures

- The surgery is performed with the patient under general anaesthesia.
- In scleral buckling, the ophthalmologist repairs wrinkles or folds in the retina and indents the eye surface to relieve the tugging pressure on the retina.
- The indentation or “buckling” is performed by placing a small piece of silicone against the outside of the sclera and holding it in place with an encircling band.
- This device keeps the retina in contact with the choroid for reattachment.
- Any fluid under the retina is drained.
- A gas or silicone oil placed inside the eye can be used to promote retinal reattachment. These agents float up and against the retina to hold it in place until healing occurs.

12.4.3 Postoperative Care

- After surgery an eye patch and shield usually are applied.
- Monitor the patient's vital signs, and check the eye patch and shield for any drainage.
- Activity after surgery varies.
- If gas or oil has been placed in the eye, teach the patient to keep his or her head in the position prescribed by the surgeon to promote reattachment.
- Teach the patient to report any sudden increase in pain or pain occurring with nausea to the surgeon immediately.
- Remind the patient to avoid activities that increase intraocular pressure (IOP).
- Instruct the patient to avoid reading, writing, and close work, such as sewing, in the first week after surgery because these activities cause rapid eye movements and detachment.

- Teach him or her the manifestations of infection and detachment (sudden reduced visual acuity, eye pain, pupil that does not constrict in response to light) and to notify the surgeon immediately if these manifestations occur.

Self- Assessment Exercise 2:

1. Name two treatment approaches to rhegmatogenous retinal detachment.
2. Why may it be necessary to 'position' a patient with a superior retinal detachment?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

12.5 Discharge advice

Good preoperative preparation will help to prevent patients experiencing most difficulties on discharge.

Positioning

- The patient's plans to cope with their limited activities postoperatively should be discussed with them as soon as possible.
- This needs to include planning for meals and shopping for food. Relatives and friends may need to assist.
- Suitable activities also need to be planned to fill their leisure time, and might include listening to the radio or 'talking books'.
- For patients required to keep their 'head down', large-print books, playing cards or board games may be useful.
- Regular visitors can be very helpful too.
- Short car journeys (as a passenger!) make visits to relatives and friends' homes possible if the prescribed head position can be maintained in the car and on arrival.
- Maintaining the prescribed position is a major contributor to the success of the eye surgery.
- Equipment to help with positioning while sitting at home (such as a small adjustable table and pillow to rest the head) on will need to be considered.

Eye care

- There is need to discuss anticipated swelling and discomfort, eye bathing if necessary, eye-drop instillation, pain relief and a telephone contact just in case the patient has any concerns or needs further advice.
- This verbal guidance should be backed up with a printed patient guide on the condition.
- Make sure that the patient can instil their eye-drops and has an adequate supply of prescribed medications.

- An outpatient follow-up appointment must be booked, and should include transport arrangements if necessary.

Air travel

This is not permitted for patients who have had intra-vitreal gas inserted, as the slightly lower air pressure in the cabin during flight will cause the gas to expand and the intraocular pressure to rise. The gas is absorbed naturally within a few weeks following insertion.

12.6 Summary

This unit highlighted problems involving the retina and various treatment modalities employ to solve the problems including nursing care before, during and after surgery and advise on discharged from the hospital.

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12.8 Answers to Self-Assessment exercises

Answers to Self-Assessment exercise 1

1. Short-sightedness, Cataract surgery, ageing.
2. A retinal detachment is a separation of the nervous layer from the pigment layer of the retina.

Answers to Self-Assessment exercise 2:

1. Any two from laser treatment, cryothermy and explant (plomb, encirclement, retinopexy, silicone tamponade, vitrectomy).
2. Because the retina is in danger of 'peeling off' further. If the macula is still 'on' then the situation is more critical.

Unit 13: Macular Degeneration

Unit 13: Macular Degeneration

13.1 Introduction

The macula is contained within an area of the retina called the fundus. It is prone to age changes like all other structures of the human body. With ageing, cellular structures deteriorate and atrophy (waste away).
You may see the name of this condition abbreviated in patient records and in the media. It is commonly called AMD, but ARMD is sometimes used in older documentation. AMD is an eye condition that leads to a progressive loss of central vision. People generally retain their peripheral vision, but the ability to see well enough to recognise faces, drive and read is grossly compromised, often leading to anxiety and depression.

13.2 Learning Outcomes

On completion of this unit you will:

- Understand what macular degeneration is.
- Identify the early detection and treatment of different types of degeneration
- Be aware of the available diagnostic tests and investigations
- Appreciate the significance of offering health education and suggesting lifestyle changes to your client groups.

13.3 Main Content: Macular Degeneration

Macular degeneration is the deterioration of the macula (the area of central vision) and can be age-related or exudative. Age-related macular degeneration (AMD) has two types. The most common type is dry AMD, caused by gradual blockage of retinal capillaries, allowing retinal cells in the macula to become ischemic and necrotic. Central vision declines, and patients describe mild blurring and distortion at first. Eventually the person loses all central vision.
This loss of visual sensory perception affects independence, well-being, and quality of life. It is often the reason an older adult leaves his or her independent living environment and moves into an assisted-living facility (Touhy & Jett, 2014).
Dry AMD is more common and progresses at a faster rate among smokers than among non-smokers. Other risk factors include hypertension, female gender, short stature, family history, and a long term diet poor in carotene and vitamin E.
Another cause of AMD is the growth of new blood vessels in the macula, which have thin walls and leak blood and fluid (wet AMD).
Exudative macular degeneration is also a type of wet macular degeneration but can occur at any age. The condition can occur in only one eye or in both eyes. The person with dry AMD can also develop exudative macular degeneration. Patients with exudative degeneration have a sudden decrease in vision after a detachment of pigment epithelium in the macula. Newly formed blood vessels invade this injured area and cause fluid and blood to collect under the macula (like a blister), with scar formation and visual distortion.

13.3.1 Factors that may contribute to the development of AMD

Genetic factors
Genetic factors have been known for some years to influence the development of AMD. Baird et al. (2008) also revealed an interaction between genetic factors, the environment the person lives in, and exposure to chronic infection, which may be involved in progression of the disease.

Smoking
Research by Cong et al. (2008) indicates that smoking, especially current smoking, was significantly associated with an increased risk of AMD and its subtypes.

Obesity
Connections between obesity and any increased risk of developing AMD are inconsistent. However, Johnson (2005) inferred that the mechanism by which obesity increased the rate of AMD development might be related to the physiological changes associated with increased weight gain, which include oxidative stress.

Race
Bressler et al. (2008) noted that white people were more likely than black people to have medium or large drusen, pigment abnormalities and advanced AMD. Their data suggests that black people may have a natural mechanism for protection against these changes in the fundus area.

Gender
Women have higher rates of AMD than men. However, Feskanich et al. (2008) noted that current post-menopausal hormone replacement (HRT) users had a 48% lower risk of neovascular AMD compared with those who had never used HRT. The risk of developing AMD was lowest for HRT users who had previously used oral contraceptives. There was a 26% lower risk of developing early AMD for parous women. The proportionately greater risk to women might in fact be attributable to their greater longevity.

Diet
Tan's (2008) population-based study demonstrated that dietary antioxidants reduced the risk of AMD.

Prolonged sun exposure
The effects of light exposure on the development of AMD are not satisfactorily proven. The difficulty of estimating light exposure in a large sample is a problem.

13.3.2 How AMD develops

AMD is a condition that develops in mature people. Its causes, at a cellular level, are still not fully understood, but Zarbin (2004) provides a reliable five-stage analysis which is summarised below:

- AMD is linked to the ageing process and is multifactorial.
- Oxidative stress results in damage to the retinal pigment epithelium and possibly secondarily to the choroidal blood flow.

- Damage to the retinal pigment epithelium leads to chronic inflammation within Bruch's membrane, which lies between the retinal pigment epithelium and the choroid.
- Damage and inflammation in the choroidal circulation leads to the formation of an abnormal extracellular matrix that alters the diffusion of nutrients to the retina and retinal pigment epithelium, resulting in further retinal damage.
- The abnormal extracellular matrix results in changes to the retinal circulation, resulting in atrophy and new blood vessel growth in the choroid.

This is, of course, just one theory among many, but all of them are similar. Friedman (2008) also points to the theory of impaired choroidal perfusion and the development of drusen (tiny yellow deposits lying beneath the retinal blood vessels, which can merge into larger masses) in the pathogenesis of AMD, and additionally highlights the increase in scleral rigidity which accompanies ageing and serves to impair choroidal perfusion.

Self-Assessment exercises

1. Name two possible contributing factors to the development of AMD.
2. Which is the commonest type of AMD?
3. Give two possible symptoms of AMD.
4. Which tests might the ophthalmologist require to establish the diagnosis of wet AMD?

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

13.3.3 Classification of AMD

As already mentioned above. AMD can be classified into two types:
Dry AMD – this accounts for around 90% of the total number of people with AMD
Wet AMD – this occurs in around 10% of people with AMD.
The way the AMD is classified will determine the treatment.

13.3.4 Symptoms of AMD

These include:

- metamorphosia (distortion in the central field where straight lines appear bent)
- subdued colour perception
- sudden reduction in central visual acuity; or
- gradual reduction leading eventually to a central scotoma (blind spot) that occurs as a result of scar tissue formation (this is obviously a sign rather than a symptom).

Often the optometrist will already have noticed that the patient is developing this condition because the formation of increased drusen at the macular area is an early warning sign.

13.4 Nursing care and interventions for patients

Routes of referral to the fast track medical macular clinic can be:
Direct: via a general practitioner or ophthalmic optometrist, or
Indirect: via facsimile from a general practitioner or optometrist to the acute referral clinic/eye accident and emergency, or by self-referral over the telephone or by attending as a walk-in to the acute clinic or emergency department.
Having a comprehensive evidence-based knowledge of the symptoms of AMD is an essential requirement for any health professional responsible for receiving patient referrals from any of the above sources. It is of paramount importance that the pathway of investigation, treatment and ongoing management is initiated urgently as a narrow window of treatment opportunity may easily be missed, resulting in detrimental consequences to a patient's lifestyle, mental health and longevity.
Dry AMD has no cure. Management is focused on slowing the progression of the vision loss and helping the patient maximize remaining vision. The risk for dry AMD can be reduced by increasing long-term dietary intake of antioxidants, vitamin B12, and the carotenoids lutein and zeaxanthin. The same dietary therapy slows the progression of dry AMD.
Central vision loss reduces the ability to read, write, recognize safety hazards, and drive. Suggest alternatives (e.g., large-print books, public transportation) and referrals to community resources that provide adaptive equipment.
Care in the Reduced Visual Sensory Perception section for discussion of patient care needs.
Management of patients with exudative or wet AMD is geared toward slowing the process and identifying further changes in visual perception.
Fluid and blood may resorb in some patients. Laser therapy to seal the leaking blood vessels can limit the extent of the damage. Ocular injections with the vascular endothelial growth factor inhibitors (VEGFIs), such as bevacizumab (Avastin) or ranibizumab (Lucentis), can improve vision for the patient with wet AMD.

New patient referral

It is important that the nurse gives clear explanations to the patient about the assessment process and its purpose. The visual assessment will form the baseline from which treatment is judged to be effective and therefore a high degree of accuracy and care should be taken with the measurements and the recording of them.

13.4 1 Tests and investigations for wet and dry AMD

On arrival the ophthalmic nurse may perform a range of initial visual assessments. This might include checks of:

- distance visual acuity in both eyes (logMAR chart)
- wavy lines or distortions (Amsler charts for both eyes)
- reading visual acuity (near-vision tests)
- colour vision monitoring (Ishihara's test)
- relative afferent pupillary defect (RAPD)
- dilation of the pupils (both eyes)
- visual acuity (Snellen, logMAR and near-vision tests).

These tests are used to establish a diagnosis in the case of both dry and wet forms of AMD and to form a baseline for subsequent comparison on each visit in the case of wet AMD. The levels of nursing input will vary greatly from one clinic to another and will largely depend on the leading clinician as to the number of technical skills a nurse may need to perform proficiently.

13.4.2 Health and safety

Often it is a nurse who administers dilating drops to both eyes for the purpose of fundoscopy, either from written instructions by the doctor in the patient record or under the parameters of a patient group directive. Prior to administration it is important to ask patients whether they have any allergies, or are taking any medications, or have had any ophthalmic-related problems in the past.

Patients should be instructed not to drive to their appointments because the mydriatic and cycloplegic effect of tropicamide cyclopentolate and phenylephrine interfere with the ability to focus and significantly blur the vision and cause photophobia. This may prohibit driving under the terms of many vehicle insurance policies, so the mode of transport to the patient's home should be verified prior to dilation. These measures should be in place routinely to ensure patient safety and to fulfil our duty of care to the patient and our professional accountability in line with the code of the Nursing and Midwifery Council (NMC, 2008).

Examination by the clinician usually includes an intraocular pressure check and retinal fundoscopy. Investigations are ordered to confirm or establish a diagnosis and will provide a baseline for future comparisons. Most commonly, optical coherence tomography (OCT) and a fundus fluorescein angiography are conducted, but an indocyanine green angiography is requested if an occult (choroidal) lesion is suspected. A photographer, technician or nurse with additional skills may perform the imaging process.

13.4.3 Patient support

Access to a counselling facility after unwanted bad news is delivered is essential in order for the patient to begin to reconcile the loss of vision and all that that will mean to them. Some units will have a service to meet this need but many will not. This is where it may be advantageous for nurses to develop basic counselling skills to enable our patients to begin the grieving journey and to provide information and initiate referral to other 'helping organisations' either charitable or statutory.

13.5 Visual impairment and registration

Due to a perceived stigma about being labelled 'disabled', many patients decide not to be placed on the 'sight impaired' or 'severely sight impaired' registers. It is important to emphasise that non-registration is not going to prevent access to agencies that are able to help them.

13.6 Summary

This unit has considered some basic questions about Macular degeneration which patients with the condition may likely be worried and disorders that may need answers to. These include among others are the contributory factors to its development and advice that may be useful to the clients and family members.

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13.8 Answers to Self-Assessment exercises

1. Any two from genetic factors, smoking, obesity, race, gender, diet and prolonged sun exposure.
2. Dry. It accounts for 90% of cases.
3. Any two from distortion of straight lines, subdued colour perception and reduced visual acuity.
4. OCT (ocular coherence tomography) and angiography.

Unit 14: Ophthalmic puzzles

Unit 14: Ophthalmic puzzles

14.1 Introduction

The science of vision seems like magic in and of itself. To think a tiny little 1-inch-diameter (2.54 centimetre) organ is responsible for our being able to see the world around us - all of its colour, light and depth. To achieve this miracle of sight, light enters the eye through the cornea and makes its way to the back to the retina, located in the middle of the eye. Within the retina are a variety of rod cells and cone cells that are responsible for seeing colour and detail. The retina also contains something known as visual purple, or rhodopsin for those science buffs out there. It is this chemical that takes the messages from the eye and translates them into electrical impulses for the brain to interpret. If it weren't for the brain, vision would not be possible either. In fact, it is the brain that is key to 3-D vision, not the eye.

14.2 Learning Outcomes

At the end of this unit, learner will be able to:

- Understand what vitrectomy is all about.
- Examine the relationship between vitrectomy and Laser treatment in retinopathy.
- Understand the effect of herpes simplex infection on the eye.

14.3 Main Content

Vitrectomy is a surgical procedure undertaken by a specialist where the vitreous humour gel that fills the eye cavity is removed to provide better access to the retina. This allows for a variety of repairs, including the removal of scar tissue, laser repair of retinal detachments and treatment of macular holes. Once surgery is complete, saline, a gas bubble or silicone oil may be injected into the vitreous gel to help hold the retina in position.

14.3.1. Vitrectomy

If there is a lot of blood in the centre of the eye (vitreous gel), the patient need a vitrectomy to restore his sight. If vitrectomies is to be done in both eyes, they are usually done several weeks apart.

A vitrectomy is performed under either local or general anaesthesia. The Eye doctor makes a tiny incision in the eye. Next, a small instrument is used to remove the vitreous gel that is clouded with blood. The vitreous gel is replaced with a salt solution.

Because the vitreous gel is mostly water, the patient will notice no change between the salt solution and the original vitreous gel.

She/he will probably be able to return home after the vitrectomy. Some people stay in the hospital overnight. The eye will be red and sensitive. The patient will need to wear an eye patch for a few days or weeks to protect his eye. She/he also will need to use medicated eye drops to protect against infection.

14.3.2 What happens during Laser treatment?

Both focal and scatter laser treatment are performed in the eye clinic. Before the surgery, the eye doctor will dilate the pupil and apply drops to numb the eye. The area behind the eye also may be numbed to prevent discomfort.
The lights in the eye theatre will be dim. As the patient sit facing the laser machine, the doctor will hold a special lens to the eye. During the procedure, the patient may see flashes of light. These flashes eventually may create a stinging sensation that can be uncomfortable.
The patient will have to be assisted home after surgery by someone else. The pupil will remain dilated for a few hours and must put on a pair of sunglasses.

14.3.3 Vitrectomy and Laser Treatment in treating proliferative retinopathy.

Both treatments are very effective in reducing vision loss. People with proliferative retinopathy have less than a five percent chance of becoming blind within five years when they get timely and appropriate treatment. Although both treatments have high success rates, they do not cure diabetic retinopathy.
Once you have proliferative retinopathy, you always will be at risk for new bleeding. You may need treatment more than once to protect your sight.

14.3.4 Vision Loss from Diabetic Retinopathy

If you have lost some sight from diabetic retinopathy, ask your eye care professional about low vision services and devices that may help you make the most of your remaining vision. Ask for a referral to a specialist in low vision. Many community organizations and agencies offer information about low vision counselling, training, and other special services for people with visual impairments. A nearby school of medicine or optometry may provide low vision services.
The National Eye Institute (NEI) is conducting and supporting research that seeks better ways to detect, treat, and prevent vision loss in people with diabetes. This research is conducted through studies in the laboratory and with patients.
For example, researchers are studying drugs that may stop the retina from sending signals to the body to grow new blood vessels. Someday, these drugs may help people control their diabetic retinopathy and reduce the need for laser surgery.

14.4 Effect of Herpes simplex infections on the Eye

There are two types of herpes simplex virus.
Type 1 virus is the usual cause of cold sores around the mouth, and herpes simplex infection in the eye.
Type 2 virus is the usual cause of genital herpes. It rarely causes cold sores or eye infections.

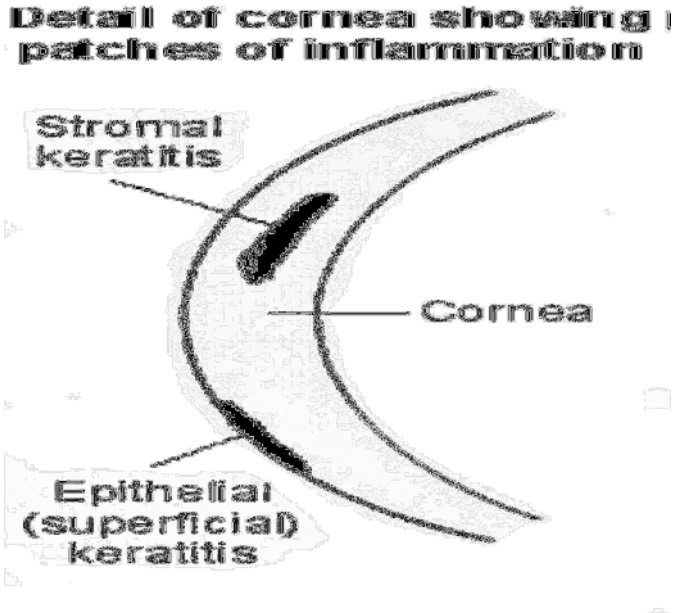
Type 1 herpes simplex infections

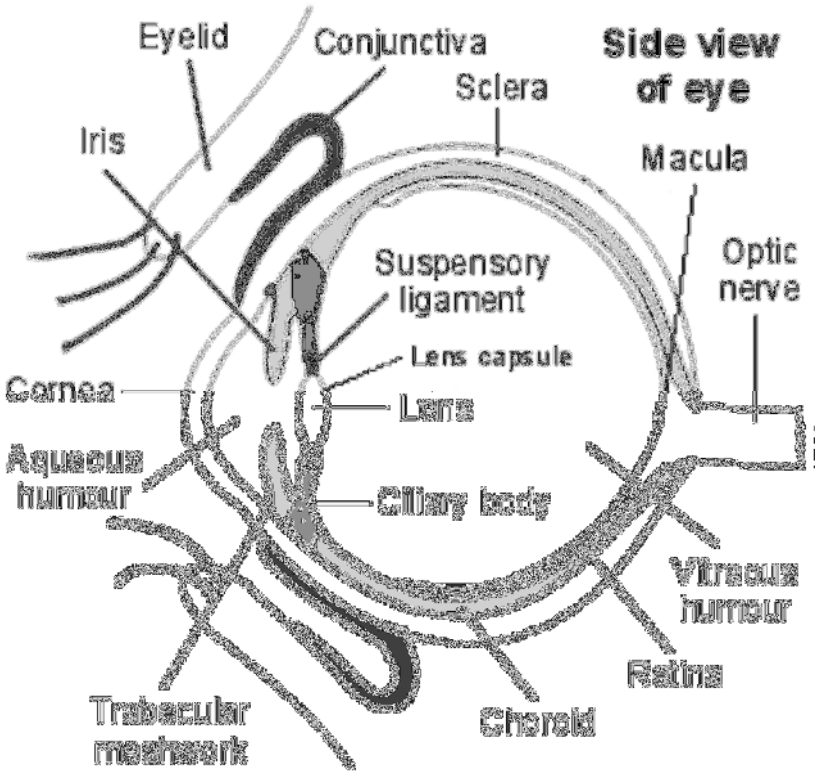
The first time you are infected is called the primary infection. Many people become infected with this virus, often during childhood. (The herpes simplex virus can pass through the moist skin that lines the mouth. It is commonly passed on by close contact such as kisses from a family member who has a cold sore.) In many people the primary infection does not cause any symptoms, although in some cases symptoms do occur. Following the primary infection, the virus stays with you for life. It stays inactive (dormant) in the root of a nerve in the face (the trigeminal nerve).

- In many people, the virus remains permanently inactive and causes no problems.
- In some people, the virus 'activates' and multiplies from time to time. Virus particles then travel down the nerve to cause episodes of active infection with symptoms.
- In most of these cases, the virus travels down a branch of the nerve to the mouth to cause cold sores.
- In some of these cases, the virus travels down a branch of the nerve to the eye to cause episodes of active eye infection. The rest of this leaflet is about herpes simplex infection of the eye.

Part of the eye affected with herpes simplex infection

The common situation is for the cornea to become infected. The cornea is the transparent 'window' of the eye. Infection of the cornea is called keratitis.





In most cases the infection is just in the top (superficial) layer of the cornea. This is called epithelial keratitis. Sometimes deeper layers of the cornea are involved. This is called stromal keratitis. This is more serious as it is more likely to cause scarring of the cornea.

Other parts of the eye are sometimes affected. A minor and temporary inflammation of the conjunctiva (conjunctivitis) or eyelids (blepharitis) may occur with active infection, often at the same time as the cornea is infected. Deeper structures such as the retina or iris are sometimes affected.

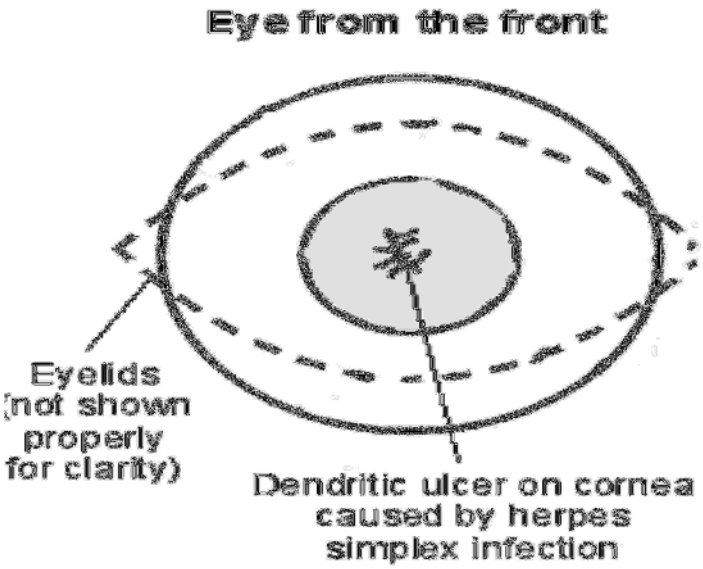
Incidence of herpes simplex infections of the eye

About 1-2 people in 1000 will develop at least one episode of active herpes simplex eye infection at some stage in their life. The most common age for a first episode is aged 30-40.

Symptoms and signs of active infection

Most episodes of active infection are due to a re-activation of the virus at some point, often years after a primary infection. Symptoms include:

- Redness of the eye - mainly around the cornea.
- Ache or pain in the eye.
- Photophobia (discomfort when opening the eyes in bright light).
- Watering of the eye.
- Blurring of vision.



An Ophthalmologist will usually examine the eye with a magnifier. They may also put some stain on the front of the eye to show up any irregular areas on the cornea. With a herpes simplex infection they will often see a small ulcer (erosion) on the cornea. The typical ulcer which develops is called a 'dendritic' ulcer. Dendritic means 'many fingered'. The ulcer is not round with a smooth edge but like a tree with many finger like branches.

If you suspects herpes eye infection in a patient, please refer urgently to an eye specialist. A specialist will do a detailed magnified examination of the eye. This is to confirm the diagnosis and to determine if the infection is in the top layer of the cornea (epithelial keratitis) or if the deeper layers are involved (stromal keratitis).

Self-Assessment Exercises

1. Mention the part of the eye that is mostly affected with herpes simplex infection.
2. What is Vitrectomy?
3. Most episodes of herpes simplex infection are due to ----------
4. Apart from antiviral eye ointment or drops, additional treatment for Stromal keratitis include ----------

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

Treatment for herpes simplex eye infection.

Epithelial Keratitis (when the top (superficial) layer is affected)

Treatment is with antiviral eye ointment or drops (such as acyclovir ointment or ganciclovir drops). These do not kill the virus but stop it from multiplying further until the infection clears. You should take the full course exactly as prescribed. This is often several times a day for up to two weeks. The aim is to prevent damage to the cornea. In some cases, a specialist may also gently scrape the affected part of the cornea to remove affected cells.

Stromal keratitis (when the deeper layer of the cornea is affected)

Treatment is similar to epithelial keratitis (above). In addition to the antiviral eye ointment or drops your specialist may add in some steroid eye drops. This helps to reduce inflammation. Note: steroid eye drops must only be used under close supervision of an eye specialist who will prescribe the correct strength and dose in conjunction with antiviral treatment. Used wrongly on their own, steroid drops causes more harm than good. Antiviral tablets are used in some cases.

If just the eyelids or conjunctiva are affected

No treatment may be advised. These infections will usually settle on their own in 1-3 weeks. You are likely to be kept under review until the infection goes to check that the cornea does not become infected.

Preventing recurring infections

Some people develop recurring episodes of active infection. As mentioned above, these occur if the virus 'reactivates' from time to time - similar to cold sores. At least half of people who have one episode of active infection will have a recurrence within 10 years of the first. In about 1 in 10 cases, the recurrence is within a year. Recurrences occur more often in some people than others.

If the recurrences are frequent (say, once a year or more) or severe, then your eye specialist may advise that you take antiviral tablets each day to prevent episodes of active infection. Studies have shown that, on average, the number of recurrences is roughly halved in people who take regular antiviral tablets.

Some people say that episodes of active herpes infection may be triggered by strong sunlight. Wearing sunglasses may also help to prevent recurrences. If a recurrence does occur, each episode is treated as described above.

Prognosis

The main concern with corneal infection (keratitis) is that it can cause scarring. With scarring the normally clear and transparent cornea become like 'frosted glass'. This can seriously affect vision.

- Epithelial keratitis tends to settle and go away in 1-2 weeks. It has a good outlook and often causes little or no scarring.
- Stromal keratitis is more likely to result in corneal scarring and loss of vision.
- Recurring episodes of active infection can make any existing scarring worse.
- Prompt treatment with antiviral eye ointment or drops helps to minimise damage during each episode of active infection.

Overall, about 9 in 10 'involved eyes' maintain good vision (good enough to drive). However, severe and recurrent herpes simplex eye infections may lead to serious scarring, impaired vision and even blindness. If blindness develops, a corneal transplant is then the only option to restore vision.

14.5 What to do to protect your vision

- Everyone with diabetes is advised to have a comprehensive dilated eye exam at least once a year.
- If you have diabetic retinopathy, you may need an eye exam more often.
- People with proliferative retinopathy can reduce their risk of blindness by 95 percent with timely treatment and appropriate follow-up care.
- A major study has shown that better control of blood sugar levels slows the onset and progression of retinopathy.
- The people with diabetes who kept their blood sugar levels as close to normal as possible also had much less kidney and nerve disease.
- Better control also reduces the need for sight-saving laser surgery.
- This level of blood sugar control may not be best for everyone, including some elderly patients, children under age 13, or people with heart disease.
- Be sure to ask your doctor if such a control program is right for you.
- Other studies have shown that controlling elevated blood pressure and cholesterol can reduce the risk of vision loss.
- Controlling these will help your overall health as well as help protect your vision.

14.6 How to do partner with the eye care professional

You can protect yourself against vision loss by working in partnership with any eye care professional. Ask questions and get the information you need to take care of yourself, your family and patients.

What are some questions to ask?

About the eye disease or disorder…

- What is my diagnosis?
- What caused my condition?
- Can my condition be treated?
- How will this condition affect my vision now and in the future?
- Should I watch for any particular symptoms and notify you if they occur?
- Should I make any lifestyle changes?

About treatment…

- What is the treatment for my condition?
- When will the treatment start and how long will it last?
- What are the benefits of this treatment and how successful is it?
- What are the risks and side effects associated with this treatment?
- Are there foods, drugs, or activities I should avoid while I'm on this treatment?
- If my treatment includes taking medicine, what should I do if I miss a dose?

About the tests…

- What kinds of tests will I have?
- What can I expect to find out from these tests?
- When will I know the results?
- Do I have to do anything special to prepare for any of the tests?
- Do these tests have any side effects or risks?
- Will I need more tests later?

Other suggestions

- If you don't understand your eye care professional's responses, ask questions until you do understand.
- Take notes or get a friend or family member to take notes for you. Or, bring a tape recorder to help you remember the discussion.
- Ask your eye care professional to write down his or her instructions to you.
- Ask your eye care professional for printed material about your condition.
- If you still have trouble understanding your eye care professional's answers, ask where you can go for more information.
- Other members of your health care team, such as nurses and pharmacists, can be good sources of information. Talk to them, too.

Today, patients take an active role in their health care. Be an active health care provider for affordable, available and accessible eye care.

Remember...

If a patient has diabetes, advise to get a comprehensive dilated eye exam at least once a year.

- Proliferative retinopathy can develop without symptoms. At this advanced stage, a patient is at high risk for vision loss.
- You can develop both proliferative retinopathy and macular oedema and still see fine. However, you are at high risk for vision loss.

The Eye care professional can tell if you have macular oedema or any stage of diabetic retinopathy. Whether or not you have symptoms, early detection and timely treatment can prevent vision loss.

14.7 Summary

This unit has considered some basic questions which any patient with the earlier described diseases and disorders may need answers to. These include among others how do I protect my vision and how do I partner with an eye care practitioner.

14.8 References/Further Readings/Web Resources

Field, D., Tillotson, J. & Macfarlane, M. (2009). Ophthalmic Study Guide for Nurses and Health Professionals. (1st Edition). M & K Publishing

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14.9 Answers to Self-Assessment Exercises

1. Cornea
2. Vitrectomy is a surgical procedure where the vitreous humour gel that fills the eye cavity is removed to provide better access to the retina.
3. Re-activation of the virus.
4. Steroid eye drops

Unit 15 Neuro-ophthalmology

Unit 15 Neuro-ophthalmology

15.1 Introduction

Neuro-ophthalmology is an academically-oriented subspecialty that merges the fields of neurology and ophthalmology, often dealing with complex systemic diseases that have manifestations in the visual system. Since diagnostic studies can be normal in patients with significant neuro-ophthalmic disease, a detailed medical history and physical exam is essential, and neuro-ophthalmologists often spend a significant amount of time with their patients.
In patients with neuro-ophthalmic disorders, there are a variety of complaints related to individual anxiety or suffering from the disorders, which lead to inconvenience and dissatisfaction in their lives. Therefore, the nursing activities related to neuro-ophthalmology patients in no standard care. The most frequent neuro-ophthalmic disorders in our inpatients are (1) optic neuropathies, (2) thyroid ophthalmopathy, and (3) idiopathic orbital inflammation. The majority of these patients are in their 30-40's, an age range with high social activity, and 60's. The chief complaints are variable in each disease, and include visual loss, visual field defect, double vision, and inconvenience due to monovision; these complaints are sometimes associated with repetitive ocular pain or headache. After-effects and the possibility of recurrences often make continuous employment of the patients difficult. In addition, most of these patients cannot work efficiently or maintain a high quality of life.

15.2 Learning Outcomes

By the end of this unit, learners should be able to:

- Discuss the nerves responsible for the innervation of all the extra ocular muscles
- Explain the nerves responsible for the innervation of just the superior oblique (SO) muscle.
- Understand the nerves responsible for responsible for the innervation of the lateral rectus of both eyes.

15.3 Main Content 1: Cranial Nerve (CN) III Palsy

Definition

Cranial Nerve (CN) III, the oculomotor nerve, is responsible for the innervation of all the extra ocular muscles except superior oblique and lateral rectus. Reduced ability of CN III will result in a variety of visual symptoms, which generally speaking result in problems with diplopia when both eyes are open.

Signs and Symptoms

- It is usually painless with a sudden onset;
- Individuals usually notice a diplopia on a certain position of gaze. This is replicable every time that the patient looks in that direction.

- The diplopia will disappear if one eye is closed and positions of gaze are duplicated.
- The affected eye eyelid may be droopy and the pupil may or may not be dilated.
- Dependent on the cause, the patient may also complain of other seemingly unrelated physical symptoms, such as lethargy, as the day goes.

Diagnosis

Diagnosis can be first elicited by careful history taking from the patient. Details should be particularly taken to ascertain initial onset of signs or symptoms and whether or not painful (particularly on movement).
Painful CN III palsy, with or without pupil involvement, must be referred to the neurosurgical team immediately because a cranial aneurysm must be excluded.
Further information is necessary to see whether the symptoms have taken a persistent and linear course and whether there have been any periods of remission. Such periods discount certain causative neurological disorders such as continuing raised intracranial pressure (ICP) and stroke.
Diagnosis can be confirmed on eliciting a symptomatic or sign response to 'follow my finger' ocular motility testing, with particular reference to pupil size. Full cranial nerve examination should be performed and recorded. Detailed orthoptic assessment is required as well as medical examination including blood pressure and blood glucose measurement. Kunimoto et al. (2004) suggest that all children under age 10 years be scanned. Pupil dysfunction results from loss of parasympathetic input and complete third nerve palsies, whether or not painful, should be assumed to result from compression of the nerve and neuroimaging be performed.

Causes

- Causes are varied, with around 25 per cent idiopathic, but, in those involving the pupil, posterior communicating artery aneurysm, tumour, cavernous sinus mass, herpes zoster (check corresponding ear for shingles) and leukaemia are common.
- In pupil-sparing CN III palsy, micro vascular disease such as in diabetes, giant cell arteritis (GCA) or temporal arteritis are among the most common causes; both of the last two can be confirmed on history taking and blood tests.
- Congenital CN III palsy is often caused by birth trauma and children may present with a CN III palsy after viral infection or immunisation, and is transient.

Likely Prognosis, Care and Treatment

Prognosis depends heavily on the cause. Common approaches include regular orthoptic or other ophthalmic practitioner review to monitor regeneration of the nerve. Initially, occluding the affected eye may be the best way of dealing with the diplopia experienced by the patient. Prisms may help to improve the field of single vision; Fresnel prisms that stick on to spectacle lenses can be a good temporary solution and the prism can be changed as the diplopia changes. If diplopia persists and stabilises, a prism may be ground into spectacle lenses. The likelihood for the patient is that at 6 months after

diagnosis the nerve should have regenerated and symptoms resolved. After 6 months, increased psychological support may assist the patient to come to terms with an altered visual ability that may be lifelong.
There is no pharmaceutical treatment or management option for a CN III palsy; however, if the cause is found to be undiagnosed or poorly controlled diabetes mellitus, control of this, through oral or insulin therapy, may lessen the time for nerve regeneration.
Once the diplopia has stabilised for at least 6 months, strabismus surgery can be done by repositioning the muscles to compensate.
This is a risky strategy because the visual rehabilitative results can be poor. Furthermore, if the nerve were to regenerate after surgery, the effects would be over-compensated resulting in worsening diplopia for the patient.
Botulinum toxin injections may be used to weaken the overacting muscle to help achieve binocular vision.
Common risks to the patient include permanent diplopia. The condition may impact on patients' livelihoods and environmental abilities to cope. Simply put, patients could become unemployed or have difficulty in everyday tasks such as making a cup of tea or judging the distance of an oncoming car when crossing the road.

Follow-Up Care

In the intervening period between presentation to ophthalmology and the wait-and-see period for monitoring the condition, particular care should be provided to the patient with regard to the adjustment to life with visual impairment. Although the patient will not experience diplopia in all positions of gaze, the effects of the CN III palsy are still likely to alter lifestyle considerably.
This is the same for all age groups from students to elderly people. Referral to the appropriate agencies is advised.

Patient Education

Patient education should, first and foremost, centre on what has happened and what is likely to happen. Although no certainties can be given at initial presentation or diagnosis, the patient's understanding of the palsy and its effects helps to gain patient compliance – such compliance minimising possible causative factors assists in nerve regeneration. Second, but just as important, compliance ensures that patients understand the condition and are likely to act to maintain a responsible attitude to treatment, monitoring the safety of themselves and others by heeding advice about activities such as smoking and driving.

15.4 Main Content 2: Cranial Nerve (CN) IV Palsy

Definition

Cranial Nerve (CN) IV, the trochlear nerve, is responsible for the innervation of just the superior oblique (SO) muscle. The SO is the longest and thinnest of the extra ocular muscles, and is responsible for the globe looking downwards, and also down and

outwards and down and inwards together with down gaze. Reduced ability of CN IV will result in a variety of visual symptoms when the eyes are moved downwards.

Signs and Symptoms

- The diplopia will disappear if one eye is closed and the position of gaze duplicated.
- Patients complain of the particular diplopia described above; occasionally they adopt a slight contralateral head tilt to the affected eye to compensate for it.
- Diplopia is increased if the head is tilted towards the affected side (Kunimoto et al. 2004).
- There is a risk to patient safety because the patient usually suffers from vertical diplopia, or diplopia with images horizontal to each other but remaining superior to the horizontal plane.

Diagnosis

Diagnosis can first be elicited by careful history taking from the patient. Further information is needed to see whether the symptoms have taken a persistent and linear course and whether there have been any periods of remission. Old photographs are useful to see whether the head tilt is long standing or there is a history of recent trauma. Diagnosis can be confirmed on eliciting a symptomatic or signed response on ‘follow my finger’ ocular motility testing. Detailed orthoptic assessment is required as well as medical examination including blood pressure and blood glucose measurements (Kunimoto et al. 2004). Eyes must be checked for facial asymmetry.

Causes

Congenital lesions are frequent and symptoms may not develop until well into adult life.
Vascular lesions of cranial nerve IV are common, but aneurysms and tumours less so. This is the most vulnerable nerve to trauma and, in older patients, micro vascular causes are most common. Inflammatory or infiltrative processes such as the restriction caused by thyroid eye disease are also important causes of CN IV palsy.

Likely Prognosis, Care and Treatment

These are as for CN III palsy.
A lack of recovery after 3–4 months should prompt neuroimaging with contrast to look for lesions within the base of the skull.

Follow-Up Care

This is as for CN III palsy.

Patient Education

This is as for CN III palsy.

Self-Assessment exercises

1. Patients with neuro-ophthalmic disorders variety of complaints related to ---------- and ----------
2. ---------- is responsible for innervation of the lateral rectus of both eyes.
3. ---------- is the longest and thinnest of the extra ocular muscles, and is responsible for the globe looking downwards.

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

15.5 Main Content 3: Cranial nerve VI Palsy

Definition

Cranial Nerve (CN) VI, the abducens, is a small nerve responsible for the innervation of the lateral rectus of both eyes.

Signs and Symptoms

This is usually a sudden onset associated with no other problems; individuals usually notice a diplopia on looking left or right, which can be replicated every time that the patient looks in that direction.

Diagnosis

Diagnosis can be first elicited by careful history taking from the patient. Details should be particularly taken to ascertain initial onset of signs or symptoms and whether or not painful (particularly on movement).
Further information is needed to see whether the symptoms have taken a persistent and linear course and whether there have been any periods of remission. Such periods of remission discount certain causative neurological disorders such as continuing raised ICP and stroke.
Diagnosis can be confirmed on eliciting a symptomatic or signed response on ‘follow my finger’ ocular motility testing, with particular reference to pupil size. Full cranial nerve examination should be performed and recorded. Detailed orthoptic assessment is required as well as medical examination including blood pressure and blood glucose measurement. Cranial CT or magnetic resonance imaging (MRI) is often required, particularly in patients aged under 40. Kunimoto et al. (2004) suggest that all children under age 10 years be scanned. Children Cranial nerve VI palsy often present after a

viral illness and this has an excellent prognosis, but, if it is not resolving, neuroimaging should be performed to rule out intercranial lesions. CN VI palsy is also associated with leukaemia in children.
A number of other conditions can mimic CN VI palsy and will therefore need specific investigation. These include myasthenia gravis, restriction caused by thyroid eye disease, medial orbital wall fracture causing restriction of muscle movement and myositis (Kanski 2007).

Causes

CN VI arises in the pons, close to the facial nerve. Damage to the this nerve within the brain stem may produce an associated facial palsy. Raised intercranial pressure may stretch the nerve, causing a bilateral palsy. Acoustic neuroma or meningioma in the cerebellopontine angle may involve CN VI and other nerves, causing, for example, deafness or facial palsy, an aneurysm, inflammation or a space-occupying lesion within the cavernous sinus and ischaemia from diabetes mellitus or hypertension. The nerve is also vulnerable to injury. As with cranial nerves III and IV, microvascular causes associated with diabetes are one of the most common causes. Isolated nerve VI palsy in adults is usually benign.
Common alternative causes are neurological causes, such as stroke, and myogenic causes, such as myasthenia gravis.

Likely Prognosis, Care and Treatment

These are as for CN III palsy.

Follow-Up Care

This is as for CN III palsy.

Patient Education

This is as for CN III palsy.

15.6 Summary

This unit assesses the three cranial nerves palsy that are closely related to the eye condition. The signs and symptoms; causes and likely treatment/prognosis were identified.

15.7 References/Further Readings/Web Resources

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15.8 Answers to Self-Assessment exercises

1. Anxiety or suffering from the
2. Cranial Nerve (CN) VI, the abducens
3. Superior oblique muscles

Unit 16 Effect of Ageing on the Eye

Unit 16 Effect of Ageing on the Eye

16.1 Introduction

Everyone's vision deteriorates with age, but there are ways to lessen its impact. This unit will examine various dimensions of aging on the eye.

16.2 Learning Outcomes

At the end of this unit, the learner will be able to:

- Explain aging in the context of vision
- Highlight the protective structures of the eye
- Describe the anatomic changes in vision during aging
- Understand the basic eye properties.

16.3 Main Content

16.3.1. Eye and Aging

The eye converts rays of light into electrical signals. The brains convert these signals and therefore we are able to see. To get a clear image we have to bend the rays of light so that they join together exactly on the retina in the rear of the eye.
First the rays of light are bent by the surface of the cornea and eventually by the natural lens.
The cornea is the outer layer of the eye. It is transparent and has a spherical shape. The rays of light which enters the eye are bent by the cornea.
The natural lens, which is flexible and can accommodate of shape, is behind the pupil and it converts the fine-tune of the rays. A strong bending of the lens is for instance needed for reading. Between the 40th and 50th year of life the lens will become less flexible and old person's far-sightedness starts. Later on, the lens can become turbid and tough. This is a matter of cataract.
In middle age, the lens of the eye becomes less flexible and less able to thicken, and thus less able nearby objects, a condition called presbyopia. Reading glasses, or bifocal lenses, can help compensate problem.
In old age, changes to the sclera (the white of the eyes) include yellowing or browning due to many years of exposure to ultraviolet light, wind, and dust; random splotches of pigment (more common in people with a dark complexion); and a bluish hue due to increased transparency of the sclera.
The number of mucous cells in the conjunctiva may decrease with age. Tear production may also decrease with age, so that fewer tears are available to keep the surface of the eye moist. Both of these changes explain why older people are more likely to have dry eyes.
Arcus senilis (a deposit of calcium and cholesterol salts) appears as a gray-white ring at the edge of the cornea. It is common in people older than 60. Arcus senilis does not affect vision.

Some diseases of the retina are more likely to occur in old age, including macular degeneration, diabetic retinopathy, retinal detachment and cataracts among others.
The muscles that squeeze the eyelids shut decrease in strength with age; this, combined with gravity and age-related looseness of the eyelids, sometimes results in the lower eyelid falling away from the eyeball, a condition called ectropion. In some older people the fat around the orbit shrinks, causing the eyeball to sink into the orbit. Because of lax tissues in the eyelids, the orbital fat can also bulge forward into the eyelids making them appear constantly puffy.
The muscles that work to regulate the size of the pupils weaken with age. The pupils become smaller, react more sluggishly to light, and dilate more slowly in the dark. Therefore, people older than 60 may find that objects are not as bright, that they are dazzled initially when going outdoors (or when facing oncoming cars during night driving), and that they have difficulty going from a brightly lit environment to a darker one. These changes may be particularly bothersome when combined with the effects of a cataract.
Other changes in eye function also occur as people age. The sharpness of vision (acuity) is reduced despite use of the best glasses, especially in people who have a cataract, macular degeneration, or advanced glaucoma. The amount of light that reaches the back of the retina is reduced, increasing the need for brighter illumination and for greater contrast between objects and the background. Older people may also see increased numbers of floating black spots (floaters). Floaters usually do not significantly interfere with vision.
As the eye ages certain changes occur that can be attributed to solely the aging process. Most of these anatomic and physiologic processes follow a gradual decline. Although these processes are distinct from the aging eye diseases, the vision changes they produce may be similar, albeit smaller. Physicians and researchers do not usually pay much attention towards understanding this aging related decline in eye functioning, perhaps because of the enormous focus on the effort to understand and treat the blinding aging eye diseases like glaucoma and macular degeneration.

16.3.2 Protective features of the Eye

The eyes are protected in a natural way. They are safely in sockets to stand rough handling.
Besides they are extra protected by the lids which can close in a reflex when danger threatens.
One winks the lids about ten to fifteen times a minute. In a smoky area, in stress or in concentration it happens even more. The importance of winking is that every time a little tear water is spread over the eye. Tear-water protects the eyeball from drying and kills damaging bacterium. The whiskers protect the eye against dirt, small insects and sunlight, while the brows protect the eyes from rain or sweat.

16.3.3 Anatomical Changes

Aging causes laxity and downward shift of eyelid tissues and atrophy of the orbital fat. These changes contribute to the aetiology of several eyelid disorders such as ectropion,

entropion, dermatochalasis, and ptosis. The higher eyelid skin crease and ptosis may be due to age related disinsertion of the levator muscle aponeurosis, and to involutional atrophy of the orbital fat. The horizontal eyelid fissure shortens by about10% with aging with aging a prominent white ring develops in the periphery of the cornea- called arcus senilis. The numbers of corneal endothelial cells gradually decrease in number.
The vitreous gel undergoes liquefaction and its opacities - visible as floaters gradually increase in number.

16.3.4 Vision changes

With aging, the quality of vision worsens due to reasons independent of aging eye diseases. While there are many changes of significance in the non-diseased eye, the most functionally important changes seem to be a reduction in pupil size and the loss of accommodation or focusing capability. The area of the pupil governs the amount of light that can reach the retina. The extent to which the pupil dilates also decreases with age because of the smaller pupil size; older eyes receive much light at the retina. The light adapted eye of a 20 year old receives six times more light than that of an 80 year old. In dark adapted conditions, the 20 year old eye receives about 16 times more light. In comparison to younger people, it is as though older persons were wearing medium-density sunglasses in bright light and extremely dark glasses in dim light.
To maximize the light entering the eye, make sure that your eye glasses have antireflective coating. Anti-reflective lens coatings significantly reduce surface reflectance and allow greater light transmission through the lens. For CR-39 lenses, approximately 8% of transmitted light is lost to reflectance on the lens surfaces – 4% on the front surface, and 4% on the back surface. Only about 92% of light entering the lens is transmitted to the lens wearer’s eyes. A high index material with a refractive index of 1.6 is transmitting only about 90% of incident light, with 10% lost to reflectance. However, when AR coating is applied to both the front and back surfaces of a lens, the percentage of transmitted light for both CR-39 and high index lenses increases to approximately 99%.

16.3.5 Changes in the Eye

Eyelids

Aging of the skin tissues produces gradual loss of elasticity, with wrinkling and drooping folds (dermatochalasis). There may be fatty alteration of the tissues (xanthelasma).

Conjunctiva

Senile plaques and degenerative infiltrates occasionally are found.

Cornea

The cornea may show circular infiltration of degenerative material within the limbus (“arcus senilis”). A flattening of curvature of the vertical meridian tends to produce distorted vision.

Lens

The lens continues to grow throughout life, although in senescence the rate of growth decreases. The consistency changes from the soft plastic juvenile lens to an almost "glasslike" character, with increasing difficulty in change of shape with attempted accommodation (presbyopia).
Disturbances of lens metabolism may produce tissue changes with resultant loss of transparency (cataract). Older people have some degree of cataract.

Vitreous

Increase in "floaters" (muscae volitantes) due to fibrillar condensations, exudates, degenerative deposits, or asteroid hyalosis; detachment and liquefaction of vitreous.

Choroid & Retina

Arteriosclerosis of the vessels of the choroid and retina may be followed by degenerative changes in these tissues.
For any detailed visually guided tasks on which performance varies with illumination, older person requires extra lighting. Aging causes a dramatic slowing in dark adaptation that can be attributed to delayed rhodopsin regeneration in the retinal photoreceptors. This age related delay in dark adaptation may also contribute to night vision problems commonly experienced by the elderly.
Colour vision and contrast sensitivity are also affected by aging. Colour vision changes cause some reduction of ability to discriminate blues and blue-greens. The yellowing of the lens is believed to be responsible for this effect. The aging lens and cornea causes glare by light scattering, especially for shorter wavelengths.
Stray light and lenticular fluorescence washes out contrast.
Wavefront aberrations of the cornea also increase with age, leading to poor vision quality especially when the pupil dilates as in the dark.
The most aggravating aspect of vision in an older person seems to be the feeling that it does not work as effortlessly or as quickly as it did in younger days. They must concentrate harder and require higher levels of illumination than they formerly did in order to have the same perceptual results. Although plain seeing in simplified situations, as in routine vision testing, is as good and as quick as ever, perceiving a complex, changing scene is more difficult and slower. The older person sees parts almost as well as they ever did but organizing of the perception as a whole is more time consuming and require more attention.

Self- Assessment Exercise 1

1.The Eye converts rays of lights into _____
2.To maximize the light entering the Eye, make sure the glasses have _____
Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

16.4 Lighting the way: A key to independence

Everyone's vision deteriorates with age, but there are ways to lessen its impact. Good lighting can make the difference between seeing and not seeing for older adults.
Here are some home lighting tips for the elderly:

- Naked bulbs: These are worst for older eyes, producing a glare that can be disorienting and painful. Chandeliers are problematic for the same reason.
- Task lighting: It makes sense to have a place in the house to do paperwork. Light should be concentrated on the work, not toward the eyes. Adjustable lamps with shades that direct light are recommended. A good choice is a compact fluorescent light with electronic ballast that starts up without flickering. Lights should be installed over countertops and stoves.
- Bathroom lighting: Lots of light should be provided overhead and even in the shower, where accidents are particularly common. 'Hollywood' lights around the mirror are a poor choice; better is a rectangular fluorescent lamp with an opaque cover to block glare and distribute light upward and outward.
- Bulb choice: Be cautious of cheap fluorescent bulbs. Look for phrases such as "high colour" or "excellent colour rendering," since older eyes often have difficulty defining colours. An 80 or above 'cri' (colour rendering index) is recommended. An advantage of fluorescent lighting is its 'blue' energy, which helps older people see colours.

16.3.6 Changes in the Eyes Properties

Some properties of the eye change roughly linearly with age and present opportunity for non-invasive assessment of age. Three of these properties are:

- Lacrimation
- Fluorescence of the cornea and lens;
- Accommodation.

The first two are objective, whereas the third requires cooperation from the individual. Lacrimation and accommodation decrease with age. Fluorescence of the cornea and lens increase with age. Although specialist equipment and a clear understanding of what one is doing are essential, the tests lend themselves to rapid assessments for incorporation in a set of other age estimates.

Self-Assessment Exercise 2

1.Mention four (4) home lighting tips for the elderly Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

16.5 Summary

This unit has discussed the effect of aging on the eye. We touched on aging, protective features of the eye, vision changes, lighting the way: a key to independence, anatomical changes and changes in the eyes properties.

16.6 References/Further Readings/Web Resources

Field, D., Tillotson, J. & Macfarlane, M. (2009). Ophthalmic Study Guide for Nurses and Health Professionals. (1st Edition). M & K Publishing

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16.7 Answers to Self-Assessment Exercises 1

1. Electrical Signals
2. Antireflective Coating

Answers to Self- Assessment Exercise 2

1. Naked bulb
2. Bathroom lighting
3. Task lighting
4. Bulb Choice

End of the Module Questions

Distinguish between dry and wet macular degeneration

Module 5 Wound of the Eye and Basic Care

Unit 17 Infection control in ophthalmology

17.1 Introduction

Hospital-acquired infection (HAI) is costly for both the patient and the carer, not only financially but also personally. In particular, there is public and professional concern about meticillinresistant Staphylococcus aureus (MRSA) and Clostridium difficile infections.

It is well known that one of the most effective means of preventing infection is good hand hygiene and Lankford et al. (2003) found that role models play an important function in compliance with hand washing. They noted that, if senior staff did not wash their hands when juniors were present, the junior was likely to mimic that behaviour.

The World Health Organization (WHO) has developed guidelines on hand washing, including the importance of keeping hands well maintained and using moisturiser at the end of a shift (WHO 2020). Due to the advent of COVID-19, globally, the 'clean your hands' campaign has reinforced this.

Eye infection may be bacterial, viral, chlamydial, fungal, and these infections account for a large proportion of the workload in ophthalmic centres. Cross-infection may occur through contaminated instruments, hands, communal towels and droplets. Patients with dry eye or inadequate lid closure are more susceptible. Other risk factors are low immunity, malnutrition, general disease and extremes of age.

17.2 Learning Outcomes

By the end of this unit, learners should be able to:

- Define Hospital-acquired infection (HAI)
- Describe the general principles of infection control in ophthalmic care.
- State the factors that complicate the nursing care in the ophthalmology unit.

17.3 Main Content: Hospital-acquired infection

Hospital-acquired infections, also known as healthcare-associated infections (HAI), are nosocomially acquired infections that are typically not present or might be incubating at the time of admission. These infections are usually acquired after hospitalization and manifest 48 hours after admission to the hospital.

Most common types of HAI:

Hospital-acquired infections are caused by viral, bacterial, and fungal pathogens; the most common types are bloodstream infection (BSI), pneumonia (e.g., ventilator-associated pneumonia [VAP]), urinary tract infection (UTI), and surgical site infection (SSI).

17.3.1 General Principles of Infection Control

In many western hospitals, in recent years, the appointment of an Infection Control Officer (usually a nurse) has become commonplace. This highlights the significance

and challenge of infection control within clinical areas. Indeed a considerable number of infections are actually acquired within a hospital setting.

● Personal hygiene and clothing

All healthcare workers of all disciplines have responsibility for infection control and this begins with their own personal hygiene. Individuals with any infection should not have direct patient contact. Any infected or potentially infected lesion must be covered with an occlusive dressing and reported to the person-in-charge who will decide if the staff member should take sickness leave until the infection has cleared.
Clothing should be changed daily. Studies have shown that hospital uniforms, over the course of a day, become a source of bacterial infection. Jewellery, including wrist watches, should not be worn and fingernails should be kept clean and cut short. Clothing worn in the operating theatre must not be worn in other areas. Hair must be kept clean and covered.
Beards are a source of infection. Facemasks must be worn properly to cover the nose, mouth and chin completely, changed for each operation and disposed of carefully. Cotton masks must be washed before re-using

● Hand washing

Hands are the most important 'instruments' of healthcare workers and also the principal source of cross-infection in a healthcare setting.
Hand washing is the most important of all infection control measures, yet it is usually performed inadequately. Both technique and frequency are important.

● Wet hands with clean, preferably running water
● Apply soap or cleanser
● Rub palm to palm
● Rub right palm over back of left hand
● Rub left palm over back of right hand
● Rub palm to palm with fingers interlaced
● Rub backs of fingers on opposing palms with fingers interlocked
● Rub around right thumb with left palm
● Rub around left thumb with right palm
● Rub around fingers of right hand with palm of left hand
● Rub around fingers of left hand with palm of right hand
● Rinse off soap thoroughly with clean, preferably running water, before drying well

N.B. Disposable paper towels are ideal but if a communal towel only is available for drying hands a clean one must be provided daily.
Hot-air hand dryers are not recommended!!
This is known as social hand washing and will take no longer than 30 seconds and is required before and after routine procedures in clinical areas

Hand washing Technique

● Gloves

The proper use of gloves prevents cross infection between patient and healthcare worker and vice versa. Despite the risk to self, a study in Nigeria showed that the main reason for non-compliance in wearing of gloves by healthcare workers with direct patient contact was because the practice was considered unnecessary.
Gloves should be worn on both hands whenever there is potential contact with blood and other body fluids. The wearing of gloves is recommended for all eye surgery. For many years it was accepted that some ophthalmic surgeons chose not to wear gloves because of reduction in touch sensitivity but this practice is no longer an option because of the risk of HIV and hepatitis B infection. A new, sterile pair of gloves should be worn for each patient contact.
Good quality gloves may be re-sterilized but should be checked for damage by filling with water, turning inside out and allowing to dry before re-sterilizing.
An adequate supply of gloves should always be available.
Allergy and sensitivity to the latex material is currently being widely discussed.

● Waste, spillages, linen and sharps disposal

All clinical waste must be disposed of carefully. Soiled dressings and surgical remnants must be burned immediately. Soiled linen must be removed immediately and washed separately from routine changes of bedding, etc.
Disposable needles must be disposed of immediately after use, and separately in a closed impenetrable container, appropriately labelled. This may be burned or buried, preferably daily. Therefore, a small container is better than a large one.

● Environment and equipment

Patients expect, and have a right, to be cared for in a clean, safe environment and all healthcare workers have responsibility to provide this. Basic cleaning of the hospital environment is a cost-effective method of infection control and must always be a pre-requisite for any subsequent disinfection and sterilizing procedures. The areas/- items requiring regular attention are walls and ceilings (often forgotten or ignored), floors, tables, stools and chairs, shelving and work surfaces.

Specific Considerations for Ophthalmic Practice

A separate unit for eye patients is ideal, but where this is not possible care must be taken that patients with open infected wounds, ulcers or bed-sores are not accommodated in the same area as eye patients.
Patients with eye infections should be separated from other ophthalmic patients in the ward, especially those who have had eye surgery. If surgery is performed on an infected eye the operation must be scheduled last on the operating list and the theatre cleaned thoroughly afterwards.

Hands of the examiner and patient

Eye infection can be spread by healthcare workers through simple social greeting of patients, i.e., shaking of hands. Patients often rub their eyes and contaminated hands will transfer the organism to the healthcare worker. It is important that hands are washed immediately before performing an eye examination and after the patient has left before greeting another patient.

Slit-lamp bio microscope

The areas which come into contact with the patient must be washed with soap solution between patient examinations – chin rest, head rim, not forgetting the hand grips!

Tonometer prisms

These should be wiped after use on disposable paper tissue and then placed (tip only) in a small pot of sodium hypochlorite 1% for at least 10 minutes between patients. (NOTE: The prism must be rinsed in sterile water and dried before use!!)
If there is suspected adenoviral infection the soaking must be extended to 30 minutes before re-using the same tonometer prism. A fresh sterile pot and new solution of sodium hypochlorite must be provided for every clinic session

17.3.2 Care of surgical instruments

Any instrument, apparatus, appliance, material or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings for the purpose of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,
- diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap,
- investigation, replacement or modification of the anatomy or of a physiological process,
- Control of conception, and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means.

Ineffective decontamination can result in problems via four main pathways
1. Foreign protein transfer, leading to risk of adverse reaction, or transmission of CJD in the case of prion protein.
2. Infection, via transfer of micro-organisms
3. Particulate material being introduced, leading to inflammation
4. Bacterial endotoxins.

Single-use instruments

Recommendation that, where possible, consideration should be given to using single-use devices.
Instruments marked by the manufacturer ‘for single use only’ should never be reused.

Decontamination Stages

Cleaning

Cleaning is the most important stage in the decontamination process. Cleaning can be manual or mechanical depending on the instrument.

Disinfection

Disinfection is usually achieved by the use of liquid chemicals or by moist heat. Moist heat should be the method of choice except for devices unable to withstand high temperatures.

Inspection

Inspection of instruments should be performed by staff other than those responsible for cleaning them. Magnification should be used if possible for fi ne ophthalmic instruments. Damaged instruments should be removed for repair or disposal (after decontamination); inadequately cleaned items should be returned for further cleaning.
A final visual inspection should, however, always be made by the clinician before using any instrument.

Packaging

Some instruments will form part of sets of instruments and will be packed in trays; others will be packed singly in sealed pouches.
All instruments must be traceable and the use of coloured tapes is not recommended because it may lead to inadequate decontamination.
New instruments should be etched with a unique identifying code.

Sterilisation

The preferred method is the use of saturated steam under pressure, at the highest temperature compatible with the instruments being processed. Non-solid items and wrapped packs must be sterilised in autoclaves rather than in vacuum sterilisers. Benchtop sterilisers in theatres, clinics and primary care settings are being phased out because the cleaning and maintenance cycles, even with the best will, cannot be guaranteed.

Transportation

It is important that transport containers are waterproof, secure, labelled and protect both their contents and the handler.

Storage

Appropriate storage for these instruments is important. It should be above floor level and away from all sources of heat and water.
In areas where instruments are not used frequently, storage should be 'in' rather than 'on' to avoid dust settlement on packaging.

Non-Surgical Instrumentation

No clinician can avoid leaving cell and other debris on tonometer heads, contact lenses and any other instrument that comes into contact with the eye or adnexae.
A solution containing 20,000 parts per million of available chlorine (sodium hypochlorite) is effective in reducing Transmissible Spongiform Encephalopathies. Soaking with 2% hypochlorite solution (e.g. Milton) between patients is therefore considered best decontamination practice.
Solutions should always be labelled to avoid inadvertent use.

Tonometry

Single-use options should be used whenever possible. It is obvious that single-use instrumentation should be used for patients who have, or are suspected of having, CJD; however, as this condition takes many years to develop, there is a good case for assuming that all patients potentially have transmissible infection – thus treating all patients in the same way.
Reusable tonometer prisms should not be allowed to dry after use; instead they should be washed and dried immediately, then wiped with alcohol and allowed to dry. After each session they should be washed and soaked in sodium hypochlorite.

Diagnostic Contact Lenses

Between patients examinations, diagnostic contact lenses should be washed clean while moist before immersion in 2% sodium hypochlorite solution for at least 5 min, unless the solution is known to be eye safe, they should be rinsed in sterile saline and then dried.
To facilitate tracing, prisms and lenses should be moved around clinics and rooms as

Self- Assessment Exercise

1. Hospital acquired Infections are caused by _____, _____ and _____
2. Ineffective decontamination of Surgical Instruments can result in problem of four main pathways. Mention the pathway?
3. Mention the decontamination stages of Surgical Instrument

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

17.4 Summary

This unit is an overview of some common eye infections, causative pathogens and spread mode in hospital environment. This is followed by an outline of general infection control principles with additional specific considerations for ophthalmic practice.

17.5 References/Further Readings/Web Resources

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Marsden, J. (2007). An Evidence Base for Ophthalmic Nursing Practice. John Wiley & Sons Ltd.

17.6 Answers to Self- Assessment

1. Viral, Bacterial and Fungal Pathogens
2. Infection via transfer of micro- organisms

b. Bacterial Endotoxins

c. Foreign protein transfer, leading to risk of adverse reaction, or transmission of CJD in the case of prion protein.

d. Particulate material being introduced, leading to inflammation

3. Cleaning

b. Disinfection

c. Inspection

d. Packaging

e. Transportation

f. Storage

UNIT 18: NON-PENTRATING INJURIES/TRAUMA OF THE EYE

18.1 Introduction

In spite of the protection afforded by the bony orbit, the cushioning effect of the retrobulbar fat, and the lids and lashes – and in spite of the great strides made in recent years in the development of protective devices, especially the use of safety goggles- the incidence of eye injuries remains high. Childhood eye injuries continue to occur as a result of air rifle, bow and arrow, catapult (slingshot), and throwing accidents.
Pain or photophobia caused by the injury may produce blepharospasm severe enough to prevent examination of the eye. If this happens, instil a sterile topical anaesthetic. With the aid of a loupe and well-focused light, the anterior surface of the cornea is examined for foreign materials or wounds, regularity, and lustre. The conjunctiva is inspected for haemorrhage, foreign material, or tears. The depth and clarity of the anterior chamber are noted. The size, shape, and light reaction of the pupil should be compared with those of the pupil of the uninjured eye. If the eyeball is intact, the lids are carefully inspected to the fornices, evertion of the upper lid.
It is important to determine and record visual acuity (See NSC 261: Human Anatomy III). Visual acuity should be tested again upon recovery from the injury, and refraction performed if vision is below normal. This record may have legal significance.
In severe injuries it is important for the non-specialist to bear in mind the possibility of causing further damage by unnecessary manipulation. Please note that Topical anaesthetics, dyes, and other medications placed in an injured eye must be sterile.

18.2 Learning Outcomes

At the end of this unit, the learner is expected to:

- What are non- penetrating injuries of the eyeball
- Describe the signs and symptoms of non-penetrating wounds of the eye

18.3 Main Content

18.3.1 Non-penetrating injuries of the eyeball: Abrasions

Abrasions of the lids, cornea, or conjunctiva do not require surgical treatment. They should be cleansed of imbedded foreign material. In order to facilitate the examination, the pain associated with abrasions of the cornea and conjunctiva can be relieved by instillation of a topical anaesthetic such as 0.5% tetracycline solution, but routine instillation of a topical anaesthetic by the patient must not be permitted since it delays normal healing of the epithelium. Ophthalmic antibiotic ointment instilled into the eye lessens the chanced of infection.
An eye bandage applied with firm but gentle pressure lessens discomfort and promotes healing by preventing movement of the lids over the involved area. The dressing should be changed daily and the wound inspected for evidence of infection or ulcer formation. Corneal abrasions cause severe pain and may lead to recurrent corneal erosion, but they rarely become infected.

18.3.2 Contusions

Contusions of the eyeball and its surrounding tissues are commonly produced by traumatic contact with a blunt object. The results of such injury are variable and are often not obvious upon superficial examination. Careful study and adequate follow-up are indicated. The possible results of contusion injury are haemorrhage and swelling of the eyelids (ecchymosis, “black eye”), sub-conjunctival haemorrhages, oedema or rupture of the cornea, haemorrhage into the anterior chamber (hyphema), rupture of the root of the iris (iridodialysis), traumatic paralysis of the pupil (mydriasis), rupture of the iris sphincter, paralysis or spasm of the muscles of accommodation, anterior chamber angle recession with subsequent secondary glaucoma, traumatic cataract, dislocation of the les (subluxation and luxation), vitreous haemorrhage, retinal haemorrhage and retinal oedema (most common in the macular area, called commotion retina, or Berlin’s traumatic oedema), detachment of the retina, rupture of the choroid, and optic nerve injury.

Many of these injuries cannot be seen on external observation. Some, such as cataract, may not develop for many days or weeks following the injury.

Except for injuries involving rupture of the eyeball itself, most of the immediate effects of contusion of the eye do not require immediate definitive treatment.

However, any injury severe enough to cause intraocular haemorrhage involves the danger of delayed secondary haemorrhage from a damaged uveal vessel, which may cause intractable glaucoma and permanent damage to the eyeball. Patients who show evidence of intraocular haemorrhage should be put at absolute bed rest for 4 or 5 days with both eyes bandaged to minimize the chance of further bleeding.

Secondary haemorrhage rarely occurs after 72 hours. A short-acting Cycloplegic such as 5% Homatropine may be used. Aretazolamide, Mannitol, or other systemically administered agents to lower intraocular pressure may be necessary.

Self- Assessment Exercise 1

1. Abrasions of the lids, Cornea or Conjunctiva requires surgical treatment? True/ False

2. Secondary Haemorrhage rarely occurs after _____ hours
a. 60
b. 30
c. 72
d. 45

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

18.4 Rupture of the Eyeball

Rupture of the eyeball may occur as a result of penetrating trauma or of contusion which causes a sudden increase in intraocular pressure, causing the wall of the eyeball to tear at one of the weaker points. The most common site of rupture is along the limbus; occasionally, rupture occurs around the optic nerve. Anterior ruptures can be repaired surgically by interrupted sutures unless intraocular contents are so deranged that useful function of the eye is not possible, in which case enucleation is required.

18.5 Corneal and Conjunctival Foreign Bodies

Foreign bodies are the most frequent cause of eye injury. Small metallic or non-metallic foreign bodies are frequently blown into the eye and may become lodged under the upper lid or be embedded in corneal epithelium. In removing foreign bodies, a sterile topical anaesthetic is essential. Minute corneal foreign bodies that are not readily visualized with the naked eye or loupe may be outlined with sterile fluorescein. If a foreign body containing iron has remained in the tissue for any length of time, rust penetrates the corneal tissue and must be removed to prevent further irritation.

Although foreign bodies my often be removed satisfactorily using a light and magnifying loupe, the most satisfactory method is under direct observation with the aid of the greater magnification and illumination of the slit lamp. Although the cornea is very tough, it is also thin (1mm). Care must be taken to penetrate the cornea in the process of removing a deeply imbedded foreign body. When in doubt, such deeply placed foreign bodies should be removed in the operating room where the anterior chamber can be re-formed (if necessary) under sterile conditions. Many types of instruments are used for removing superficial corneal foreign bodies, including special blades, and the points of hypodermic needles. A dental drill of the burr type is often useful for removing an imbedded rust ring from the cornea.

Following removal of the foreign body, an antibiotic ointment such as poly myxin B-bacitracin or gentamicin should be instilled 3 times a day into the conjunctival sac to prevent infection. If the wound is extensive, an eye bandage can be used to minimize movement of the lid over the injured area. The wound should be inspected daily for evidence of infection until it is completely healed.

18.6 Burns

Thermal burns of the eye structures are treated as burns of skin structures elsewhere, as the tissues of the lids are most commonly involved. If the damage has been deep enough to cause sloughing of the corneal tissue, the eye is almost certainly lost by extensive scarring or perforation.

Ultraviolet irradiation, even in moderate doses, often produces a superficial keratitis that is quite painful, although recovery occurs within 12-36 hours without complications. Pain often comes on 6-12 hours after exposure. This type of injury occurs following exposure to an electric welding arc without the protection of a filter. Many “flash burns” are caused by careless exposure in the mistaken belief that the eyes

can be burned in this way only when looking directly at the arc. A short circuit in a high-voltage line may cause the same type of injury.

In severe cases of “flash burn,” instillation of a sterile topical anaesthetic may be necessary for examination. A mydriatic (e.g., homatropine hydrobromide, 2-5%) should be used. Systemic sedation or narcotics are preferable to topical anaesthetics, which interfere with corneal healing. Patching and cold compresses are indicated to relieve discomfort.

Infrared exposure rarely produces an ocular reaction. (“Glassblower’s cataract” is rare today but once was common among workers who were required to watch the colour changes in molten glass in furnaces without proper filters.) Radiant energy from viewing the sun on an eclipse of the sun without an adequate filter, however, may produce a serious burn of the macula resulting in permanent impairment of vision. Persons using hallucinogenic drugs such as LSD have been particularly prone to solar macular burns.

Excessive exposure to radiation (x-ray) produces cataractorus changes that may not appear for many months after the exposure. The same risk is inherent in exposure to nuclear devices.

Self- Assessment Exercise 2

1. Rapture of the eye ball occurs as a result of _____

2. An antibiotic ointment should be instilled how many times a day to prevent infection

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

18.7 Summary

In this unit, we discussed non-penetrating injuries covering abrasion, contusion, rupture of the eye ball, corneal and conjunctival foreign bodies and burns.

18.8 References/Further Readings/Web Resources

Crick, R. P & Khaw, P. T. (2003) A Textbook of Clinical Ophthalmology. A Practical Guide to Disorders of the Eyes and Their Management. (3rd Edition). World Scientific.
Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.
James, B., Chew, C. & Bron, A. (2003). Lecture notes on Ophthalmology. (9th Ed) Blackwell Scientific Publications).
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18.9 Answers to Self-Assessment Exercises

Answers to Self- Assessment Exercise 1

1. False
2. 72 hours

Answers to Self- Assessment Exercise 2

1. Penetrating Trauma
2. 3 times a day

UNIT 19: PENETRATING INJURIES/TRAUMA OF THE EYE BALL

19.1 Introduction

Penetrating injuries affects the middle and inner layer of the eye. The structures includes: the lens, vitreous, and retina which are examined with an ophthalmoscope for evidence of intraocular damage such as haemorrhage or retinal detachment.
If the patient complains of a foreign body sensation but none can be seen with oblique illumination, instil sterile fluorescein. This may demonstrate an irregularity of the corneal surface due to a minute abrasion, laceration, or foreign body.
A small child may be difficult to examine adequately. If a rupture or laceration of the eyeball is suspected, it is best not to struggle but to examine with the aid of a short-acting general anaesthetic. If a severe injury is not suspected, the lids may be manually separated under topical anaesthesia with the use of lid retracting forceps.
This unit will examine few cases of penetrating injuries which occurs day to day.
Your understanding and willingness to provide the needed care will help to reduce avoidable blindness.

19.2 Learning Outcomes

At the end of this unit, the learners should be able to:

- Describe what penetrating injuries of the eyeball are.
- Distinguish between penetrating and non-penetrating injuries

19.3 Main Content

19.3.1 Lacerations

Lacerations are usually caused by sharp objects (knives, scissors, a projecting portion of the dashboard of an automobile, etc.). Such injuries are treated in different ways depending upon whether or not there are prolapsed of tissue.

A. Lacerations without Prolapse of Tissue.
If the eyeball has been penetrated anteriorly without evidence of prolapsed of intraocular contents, and if the wound is clean and apparently free from contamination, it can usually be repaired by direct interrupted sutures of fine silk or catgut. Blood clots can be gently removed from the anterior chamber by irrigation and the chamber re-formed after corneal repair by injection of normal saline solution or air. A mydriatic should be used and an antibiotic solution instilled in the conjunctival sac, and bilateral eye bandages applied. The patient should be placed at bed rest for a few days and systemic antibiotics given to minimize the chance of intraocular infection.

B. Lacerations with Prolapse:
If only a small portion of the iris prolapsed through the wound, this should be grasped with a forceps and excised at the level of the wound lip. Small amounts of uveal tissue can be removed in a similar way.

The wound should then be closed in the same manner as a wound without prolapsed, and the same follow-up care given. If uveal tissue has been injured, the possibility of sympathetic ophthalmia is always present.
If the wound has been extensive and loss of intraocular contents has been great enough that the prognosis for useful function is hopeless, evisceration or enucleation is indicated as the primary surgical procedure.

19.4 Intraocular Foreign Bodies

Foreign bodies that have become lodged within the eye should be identified and localized as soon as possible. Particles of iron or copper must be removed to prevent later disorganization of ocular tissues by degenerative changes (siderosis from iron and chalcosis from copper.) Some of the newer alloys are more inert and may be tolerated. Other kinds of particles, such as glass or porcelain, may be tolerated indefinitely and are usually better left alone.
A complaint of discomfort in the eye with blurred vision and a history of striking steel upon steel should arouse a strong suspicion of an intraocular foreign body.
The anterior portion of the eye, including the cornea, iris, lens, and sclera, should be inspected with a loupe or slit-lamp in an attempt to localize the wound of entry.
Direct ophtahlmoscopic visualization of an intraocular foreign body may be possible. An orbital soft tissue x-ray must be taken to verify the presence of a radiopaque foreign body as well as for medico-legal reasons.
Localizing x-rays can be obtained by several methods, usually by the method of Comberg, using a contact lens; or the method of Sweet, with a geometric, calculation following accurate position of the foreign body within the eye or orbit.
The Berman metal locator is an electronic instrument for detecting the presence of metals. It is useful in pinpointing an intraocular foreign body located near one of the accessible areas of the eyeball. The wand of the instrument can be sterilized and passed posteriorly over the exposed field at surgery.
If the foreign body is anterior to the lens annules, it should be removed through an incision into the anterior chamber at the limbus. If it is located behind the lens and anterior to the equator, it should be removed through the area of the parsplana which is nearest to the foreign body because less retinal damage is caused in that manner. If the foreign body is posterior to the equator, it should be removed directly through that point on the wall of the eyeball which is nearest to it, unless that area is at the macula.
If the foreign body has magnetic properties, the sterilized tip of a hand magnet (or giant magnet) near the area of exit can be used to facilitate its removal. If it is non-magnetic and removal is essential, small forceps have been devised for introduction into the posterior portion of the eye with minimal displacement and trauma. A special instrument has been devised to grasp a spherical air rifle or shotgun pellet.
Any damaged area of the retina must be treated with diathermy or photocoagulation to prevent retinal detachment.

19.5 Injuries to the lids

Many lacerations of the lid do not involve the margins and may be sutured in the same way as other lacerations of the skin. If the same way as other lacerations of the skin. If

the margin of the lid is involved, however, precautions must be taken to prevent marginal notching. The most effective technique is to freshen the lacerated edges by vertical incisions perpendicular to the lid margins through the full height of the tarsus. The incisions are then joined by a "V", thus forming a pentagonal wedge. The conjunctiva and tarsus are closed by interrupted gut sutures and the lid margin is carefully aligned with two 7-0 silk sutures: one in the posterior margin through the orifices of the meibomian glands and the other in the anterior lid margin through the lash line. The sutures are allowed to remain about 5 mm long and tied over the skin closure sutures to prevent their abrading the cornea.

If primary repair is not effected within 24 hours, oedema may necessitate delayed closure. The wound should be cleansed well and antibiotics administered. After selling has subsided, repair may be performed. Debridement should be minimized, especially if the skin is not lax.

Lacerations near the inner canthus frequently involve canaliculi. Early repair is desirable, since the tissue becomes more difficult to identify with swelling. The upper canaliculus is rarely essential to lacrimal drainage and can often serve as the sole excretory path when the lower one has been destroyed. Nonetheless, it is preferable to repair such lacerations to prevent stricture. The Veirs rod is an effective canaliculus splint in some cases. The preferred method of repair is an encircling tube of silicone. A pigtail probe is used to identify the lumen of the severed canaliculus. Silicone tubing is threaded back through the common canaliculus and uninjured punctum. A nylon suture inside the silicone tubing is knotted and the encircling tube rotated to place the knot away from the palpebral opening. Alternatively, the 2 ends of the silicone tubing may be threaded from the 2 puncta with a Quickert probe through the nasolacrimal duct and knotted beneath the inferior turbinate in the nose. These tubes should be left place for several weeks to months. They are easily removed without anaesthetic.

19.6 Injuries involving the orbit and its contents

- **Bony Injury**

Fractures of the walls of the orbit may be caused by direct blows or by extension of a fracture line from adjacent bones. The outer table of the frontal bone above the orbit may receive crushing injuries without damaging the orbital contents.

Similarly, fractures and displacement of the zygomatic bone, nasal bone and accessory sinuses, and the medial wall of the orbit can be involved in depressed injuries of the face in automobile accidents. If a fracture involves the paranasal sinuses- most frequently the ethmoid bone emphysema may be noted by creptitation on palpation. Such an involvement may be followed by the development of chronic osteomyelitis.

- **Blowout Fracture**

Isolated orbital floor or "blowout" fracture, without concurrent orbital rim fracture, usually follows blunt injury to the eye. Orbital contents herniated into the maxillary sinus, and the inferior rectus or inferior oblique muscle may become incarcerated at the fracture site.

Signs and symptoms are pain and nausea to the time of injury and diplopia on looking up or down. The infraorbital nerve is frequently damaged and anaesthesia is noted over the upper lip and gingival Enophthalmos (backward displacement of the eyeball) may not be present until the orbital oedema subsides. The facture site is best demonstrated by antral roof deformation on Waters' view x-rays or tomograms. There is limited movement of the eye even with forced ductions.

Prompt surgical reduction is indicated when a large bony defect can be demonstrated on radiography or is suspected because of enophthalmos and restricted up gaze. Forced duction is useful in distinguishing the vertical imbalance of entrapment from muscle contusion. If exophthalmoses or restricted motility is not evident, surgical repair is not necessary even if a fracture can be demonstrated.

Frequently, a decision cannot be made immediately after injury. There is little danger in waiting 7-10 days to evaluate surgical indications.

Two effective means of surgical treatment

The two effective surgical treatments for penetrating injuries and trauma are Ennucleation and Evisceration

Self- Assessment Exercise

1. _____ are usually caused by sharp objectives
2. Mention one method of obtaining localizing X- rays
3. _____ is an electronic instrument for detecting the presence of metal
4. Lacerations near the inner canthus involves _____
5. Mention two (2) effective treatment for preventing injuries and trauma

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

19.7 Summary

This unit has discussed penetrating wounds. These includes: lacerations, intraocular foreign bodies, injuries to the lids and injuries involving the orbit and its contents.

19.8 References/Further Readings/Web Resources

Crick, R. P & Khaw, P. T. (2003) A Textbook of Clinical Ophthalmology. A Practical Guide to Disorders of the Eyes and Their Management. (3rd Edition). World Scientific.

Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.

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Shaw, M. E., Lee, A., & Stollery, R. (2010). Ophthalmic Nursing. (4th edition.). Wiley-Blackwell

19.9 Answers to Self-Assessment Exercises

1. Laceration
2. Using a contact lens
3. The Barman metal locator
4. Canaliculu
5. Ennucleation and Evisceration

UNIT 20: GENERAL RULES OF EYE CARE

20.1 Introduction

This unit will discuss the general (basic) eye care that every nurse at any level of health care would be able to offer the expected eye care for the purpose of preserving the sight of everyone that comes in contact with her.

20.2 Learning Outcomes

At the end of this unit, the learner should be able to:

- Explain the routine eye examination
- Provide general information to patient/clients with eye disorders.
- Identify different signs and symptoms of general eye disorders.
- Offer eye health education to clients attending the clinic and the society at large.

20.3 Main Content

20.3.1 Routine Eye Examination

The routine ophthalmologic examination consists of careful elicitation of the patient's history, physical examination of the eyes, and assessment of visual function. The history should include not only the patient's ocular manifestations but general information about age, occupation, and physical health. Special examinations may be required to determine ocular pathophysiology or to establish the pressure of associated systemic disease. The patient's pertinent past medical records should be obtained whenever possible.

20.4 General Information

Age

The age of the patient is important not only as an etiologic factor in senile changes but also for the purpose of comparing individual abilities with established norms for the age group and in helping to determine what one might expect in the way of performance without discomfort. For example, in cases of amblyopia, occlusive treatment should improve the visual acuity of a child under age 7, whereas the same treatment in a child over 7 would be less effective. In a young child it is not too important to correct the visual acuity to 6/6 (20/20), since demands for clear distance visual acuity are much less at an early age than is the case with older school children or adults. Age also plays a role in the rate of progression of myopia, which tends to increase during the teens and levels off in the third decade.

Age is also an important factor in visual disability in the pre-presbyopic or early presbyopic period, as the symptoms of presbyopia are often quite disconcerting to a person who has had good eyesight throughout life. Proper explanation of these symptoms to the patient may postpone the need for the first pair of reading glasses of facilitates the adjustment to the first pair.

Occupation

Occupational demands for visual acuity are important in determining the treatment of visual symptoms. Special requirements, such as those involved in working with small objects or at unusual working distances, must be considered in the work fatigue balance of the visual effort. Even in the same age group, marked differences in symptoms may be noted between 2 individuals with the same refractive error whose work makes widely different demands on their eyes. Small refractive errors that produce discomfort in an accountant, for example, may be unnoticed by a labourer.

In presbyopic patients requiring occupational bifocals, special work requirements play an important role in the prescription of bifocal segments. In industrial injuries a careful record should be made of time and circumstances of injury, previous emergency treatment, and visual acuity.

20.5 Signs and Symptoms

Most of the presenting manifestations of eye involvement fall into one of 5 categories:
(1) subnormal visual acuity;
(2) Pain or discomfort,
(3) change of appearance of lids, orbit, or eye;
(4) Diplopia or dizziness; and
(5) Discharge or increase conjunctival secretion.

Some of the important features of each complaint are discussed below.

- Subnormal Visual Acuity

A. Duration: Is visual acuity the same as it has been for most of the patient's life? Was the change noted recently? Was if found by accidentally covering one eye? Has there been a gradual diminution of acuity over months or years?

B. Difference is Visual Acuity in the 2 Eyes: Is the patient certain that visual acuity was formerly the same in both eyes? Has the patient passed an eye examination as part of a driver's test or military physical examination? At that time was the visual acuity the same in both eyes?

C. Disturbances of Vision:

1. Distortion of the normal shapes of objects (metamorphopsia) is most often due to astigmatism or macular lesions.
2. Photophobia is commonly due to corneal inflammation, aphakia, iritis, and ocular albinism. Some drugs may produce increased light sensitivity (e.g. Chloroquine, acetazolamide).
3. Colour change (chromatopsia), such as yellow, white, or red vision, may be due to chorioretinal lesions or lenticular changes, or may be associated with systemic disturbances (e.g, yellow or white vision in digitalis toxicity).
4. Halos, or rings seen when viewing lights or bright objects, are typically thought of as accompanying glaucoma but are also found with other processes causing corneal oedema or infiltration as well as with lens changes. Incipient cataract is the most common cause of halos.
5. "Spots" before the eyes, seen as dots or filaments which move with the eye, are almost always due to benign vitreous opacities.

6. Visual field defects may be due to disorders of the cornea, media, retina, optic nerve, or brain. Quivering or scintillating blind spots (scotomas) may occur transiently as a result of localized constriction of cerebral or retinal arteries.
7. Night blindness, or difficulty seeing in the dark (nyctalopia), may be congenital (retinitis pigmentosa, hereditary optic atrophy) or acquired (vitamin A deficiency, glaucoma, optic atrophy, cataract, retinal degeneration).
8. Momentary loss of vision (amaurosis fugax) may imply impending cerebrovascular accident, spasm of the central retinal artery, or partial occlusion of the internal carotid artery.

- Pain or Discomfort

The usual painful symptoms mentioned are headache, “eye-ach,” and burning or Itching of the eyes or eyelids. Photophobia (sensitivity to light) may cause great discomfort; fatigue symptoms such as “pull,” “tired eyes.” And “a feeling of pressure” may be described. Acute localized pain intensified by movement of the eye or lid suggests a foreign body or corneal abrasion.
Aside from poor visual acuity, headache is the most common complaint that causes a patient to go to an ophthalmologist for an eye examination. If the eye examination discloses no pathologic abnormalities that may account for the symptom, a careful description of the type of headache and a history of its onset, relationship to use of the eyes, duration, and associated symptoms may not only rule out eye disease as a probable cause but may indicate the proper diagnosis.
For example, the headache that occurs upon arising in the morning and disappears soon afterward is seldom caused by eye disorders; a general medical examination is indicated. On the other hand, mild to moderate headaches that occur toward the end of a day of exacting eye work and that are relieved by a few hours of rest or sleep are more probably due to ocular disorders. Any case of severe headache that is becoming worse should suggest an intracranial lesion; visual field test, ophthalmoscopy, and neurologic consultation are indicated.
“Eye-ache” often accompanies extreme fatigue with or without excessive use of the eyes. It is more common in patients with muscle imbalances, but it may be present with inflammatory lesions involving the episclera, iris, or choroid. The eyes may also ache with the increased pressure of glaucoma. In severe acute congestive glaucoma, the pain may be so intense as to radiate throughout the cranium and be accompanied by nausea and vomiting. Ocular pain may also be caused by fever, neuralgia, retro bulbar neuritis, and temporal arthritis. Aching eyes constitute one of the first symptoms of severe influenza and dengue. Burning and itching may be a symptom of eyestrain, but the most frequent cause is inflammation of the lids or conjunctiva, e.g., chronic blepharitis, conjunctivitis, and allergic reactions of the hay fever type. Itching in particular, is a symptom of ocular allergy.
A sensation of “pull” is often described in adjusting to a new lens prescription, particularly if the prescription incorporates a change in astigmatic correction.
There may also be sensations of pull or actual ache in adjusting to the first pair of bifocals.

- Change in Appearance

A. Discoloration: Redness or congestion of the lids, conjunctiva, or sclera may be due to an acute inflammatory reaction to infection, trauma, or allergy or to acute glaucoma. Subconjunctival haemorrhage is sudden in onset and bright red in appearance. (Gross intraocular haemorrhage gives no external ocular sign.) Change of colour of the cornea may occur with corneal ulcer or intraocular infection, producing cloudiness of the anterior chamber or an actual level of purulent material in the anterior chamber (hypopyon). Change of colour of the "white" of the eye may be noted. Yellow sclera is usually seen with jaundice or antimalarial drug toxicity (e.g. quinacrine). Blue sclera is associated with osteogenesis imperfect.
Dark discoloration may follow prolonged local or systemic use of silver compounds (rare) or may be due to sclera thinning and degeneration.

B. Swelling: One or both lids may be swollen. Swelling of one lid suggests a local abscess; bilateral swelling indicates a more generalized reaction such as blepharitis, allergy, myxedema, or malignant exophthalmos.

C. Mass: An orbital mass may occur, causing displacement of the globe.

D. Displacement: The eyes may be displaced forward or in other directions.
There may be a change of position of the lids, either drooping (ptosis) or retracted (elevated).

- Diplopia & Vertigo

It is difficult to differentiate diplopia and vertigo without a careful history. Both may be described by the patient as "dizziness." If double vision is described, it is important to know the time of onset, whether it is constant or intermittent, whether it occurs in certain positions of gaze or at certain distances, and whether the 2 objects seen are horizontal or vertical, Monocular diplopia occurs in lenticular changes, macular lesions, malingering, or hysteria.
Vertigo or light-headedness is often (but seldom justifiably) ascribed to eye disorders since the patient frequently notes that during this time it is difficult to focus on any object or that "things seem to go around. "The attacks are frequently associated with sudden changes in posture, such as arising suddenly from a lying or seated position, or sudden changes in the position of the head or neck muscles.

- Discharge (Exudates or Epiphora)

It is important to know the type and amount of discharge, when it occurs, and whether chronic crusting or "granulation" of the lid margins occurs. If the discharge is watery (epiphora) and not associated with redness or pain, it is usually due to excessive formation of tear or obstruction of the lacrimal drainage system.
The patency of the drainage system may be examined by irrigating the canaliculi and nasolacrimal ducts. If the discharge is watery but accompanied by photophobia or burning, viral conjunctivitis or keratoconjuctivitis may be present.
A purulent discharge usually indicates a bacterial infection. A discharge seen with allergic conditions often contains a large number of eosinophilis. Samples of the exudates may be stained with methylene blue, Giemsa's Gram's, or other stains for

microscopic identification of cell types and bacteria. If necessary, further identification of bacteria may be done by culture.

- Decreased or Increased Lacrimation

Many systemic disorders are marked by decreased tearing. Dryness of the eyes is a frequent complaint in elderly patients and also occurs in several of the collagen disorders (e.g. Sjogren's syndrome) and in patients taking tranquilizers. Excessive tearing (epiphora) maybe due to chemical irritation (e.g., smog), allergy, acute inflammatory disease of the eye, or tear duct obstruction.

Self- Assessment Exercise

1. The routine Ophthalmologic examination consists of elicitation of the patient's _____, _____ and _____
2. _____ is an important factor in visual disability in the pre- presbyopic
3. Mention 5 categories of most of the presenting manifestations of eye involvement

Attempt these exercises to measure what you have learnt so far. This should not take you more than 5 minutes

20.6 Summary

Understanding the general rules of eye care required by a nurse at all levels of health care no doubt places on her a unique responsibility to contribute to the realization of Vision 2020.

This unit has discussed the routine examination, general information and the signs and symptoms that will assist the learner in understanding the general rules of eye care.

20.7 References/Further Readings/Web Resources

Crick, R. P & Khaw, P. T. (2003) A Textbook of Clinical Ophthalmology. A Practical Guide to Disorders of the Eyes and Their Management. (3rd Edition). World Scientific.

Ignatavicius, D. D., Workman, M. L. Blair, M., Rebar & Winkelman, C. (2016). Medical-Surgical Nursing, Patient-Centred Collaborative Care. (8th edition). Elsevier.

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Stein, H. A., Stein, R. M. & Freeman, M. I. (2013). The Ophthalmic Assistant A Text for Allied and Associated Ophthalmic Personnel. Elsevier Saunders.

20.8 Answers to Self-Assessment exercises

1. History, Physical examination of the eye and Assessment of visual information

2. Age

3. a Subnormal visual acuity;

b. Pain or discomfort,

c. Change of appearance of lids, orbit, or eye;

d. Diplopia or dizziness; and
e. Discharge or increase conjunctival secretion.

End of the Module Question

Discuss the five general Principles of Infection Control.