The IACLE Contact Lens Course

MODULE 4

Examination Procedures for Contact Lens Patients

First Edition

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The International Association of Contact Lens Educators

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Acknowledgements

The IACLE Curriculum Project is the result of a desire to raise the standard of eyecare education, to make contact lens wear safer and more successful, and to develop the contact lens business by creating the educational infrastructure that will produce the teachers, students and practitioners of the future.

The concept of the world's best educators making available their most creative educational contributions for the common good without any recompense, other than a sense of satisfaction, was born out of IACLE's idealism.

The Curriculum Project could not be successful without the assistance and generosity of a large number of talented and dedicated people. To all those contributors of lectures, laboratory notes, videos, slides, etc., we say thank you. Your generosity of spirit will benefit many educators, hundreds of thousands of students and millions of patients throughout the world.

The Vice President of IACLE, Professor Desmond Fonn, has made a tremendous contribution since the inception of IACLE, and has provided his considerable expertise in the final editing stage of the Curriculum. This project was commenced under Professor Brien Holden's leadership. The original plan and layout for the Curriculum was prepared by Sylvie Sulaiman, IACLE's Director of Education. Sylvie's dedication and excellent understanding of practitioner and community requirements have given the Project focus and depth.

More recently, the IACLE Curriculum Project has benefited from the work of Dr Lewis Williams as Manager, Educational Development. Dr Williams has done an amazing amount of work to achieve an impressive collation of diverse material, and has created what I believe to be an invaluable collection of contact lens knowledge. Dr Williams has also been assisted by Rob Terry's considerable experience and understanding of the contact lens field.

Kylie Knox has done an excellent job as Project Editor. To complement the efforts of the editors, layout coordinators Barry Brown and Shane Parker have done an admirable job, as have the rest of the graphics team. The Cornea and Contact Lens Research Unit (CCLRU) at the University of New South Wales has contributed substantially to this project through the donation of time, resources and editorial support.

The IACLE global staff including Director of Administration Yvette Waddell, Global Coordinator Pamela O'Brien and Executive Secretary Gail van Heerden, have expertly managed the considerable tasks of production and distribution.

No acknowledgments page in an IACLE document would be complete without a reference to its sponsors. Bausch & Lomb have been a major corporate sponsor since 1990, providing the original stimulus for IACLE's growth by contributing financial support and the involvement of individuals from their International Division. It was Dr Juan Carlos Aragon (when he was at Bausch & Lomb) who first suggested that if IACLE was to be taken seriously by industry, it needed a global plan to address the educational requirements for the safe, effective growth of the contact lens business. Johnson & Johnson Vision Products is our other major corporate sponsor. They have provided excellent assistance through their provision of industry coordinators for Europe, Africa, and the Middle East. CIBA Vision has been a corporate contributor and also provided excellent industry coordination in Latin America. Allergan and Wesley Jessen/PBH have contributed generously as corporate donors, with Alcon Laboratories, contributing as IACLE donor.

IACLE is a cooperative effort, and none of its activities are more collective than the Curriculum Project. The IACLE Contact Lens Course which resulted from this project is provided to assist educators in accredited institutions to impart eyecare and contact lens knowledge. All the contributors deserve recognition for their selflessness and talent.

Debbie Sweeney

President of IACLE

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- **Options for Wear Modality and Lens Replacement**
- **Lens Dispensing and Patient Education**
- **Conducting the After-Care Visit**
- **Slit-Lamp Examination of the Contact Lens Patient**

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- **Options for Wear Modality and Lens Replacement**
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- **Conducting the After-Care Visit**
- **Slit-Lamp Examination of the Contact Lens Patient**

Educators Guide to the IACLE Contact Lens Course

Overview

The IACLE Contact Lens Course is a comprehensive package of educational materials and other resources for teaching the subject of contact lenses. This package was designed to encompass *The IACLE Contact Lens Course Syllabus* and consists of 360 hours of lectures, practicals and tutorials in ten modules. It contains material at basic, intermediate and advanced levels. The separate document, *The IACLE Contact Lens Course Syllabus,* summarizes the course and includes outlines of Modules 1 to 10.

The teaching resources have been designed for flexibility. They allow the educator to select the materials appropriate to the students' knowledge and the educational requirements of the class, school, institution or country.

The English language reference used for the IACLE Contact Lens Course is: Brown L (Ed.). *The New Shorter Oxford English Dictionary.* 1993 ed. Clarendon Press, Oxford (UK). The only spelling exception is *mold* and *mould.* The Oxford dictionary suggests *mould* in all contexts. We chose to use *mold* for manufacturing-related matters and *mould* for fungi since both meanings and spellings appear regularly in contact lens literature. This differentiation is based on common usage. Where words are 'borrowed' from a language other than English, they are reproduced in their native form where possible.

Where standards have been ratified by the International Organization for Standardization (ISO), or where draft ISO standards are at an advanced stage, their relevant terminology and symbology are used. Système International (SI) units of measure are used wherever possible.

Many major contact lens textbooks from around the world, and some important journal articles, are referenced in the Course, and copyright illustrations are reproduced with permission of the original publishers and/or copyright owners. The References section at the end of each unit details the information sources used throughout.

Teaching Resources - Module 4

Module 4 of the IACLE Contact Lens Course consists of the following materials:

1. **Contact lens manual**

   The contact lens manual, containing:

   - Course overviews
   - Lecture outlines and notes
   - Practical outlines, exercises and notes*
   - Tutorial exercises and notes*

   * Not all units contain all these sections.

   The recommended allocation of time for the lecture, practical and tutorial components of the module are outlined in the Summary of Module 4 on page *x*. The manual provides recommended activities, references, textbooks and evaluation techniques in the interests of standardization. Ultimately however, the design and methodology of the course is left to the discretion of the contact lens educator.

2. **Slides for lectures, practicals and tutorials**

   The slides have been numbered according to the sequence in which they appear in each lecture, practical and tutorial. Single or dual slide projection can be accommodated. Each slide has an identification code. This code is based on a cataloguing system in use at the IACLE Secretariat and should be used in any communication with IACLE regarding the slides.

For example:

To re-order this slide please quote its identification code

THE ROUTINE PRELIMINARY EXAMINATION

- Slit-lamp examination of the anterior segment
- Measurement of ocular dimensions
- Assessment of the tears
- Spectacle refraction

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Symbols, Abbreviations and Acronyms Used in the IACLE Contact Lens Course

SYMBOLS			
↑	increase, high	{	collectively produced by
↓	decrease, low	}	collectively produces
→	produces, towards	Σ	sum of
←	produced by, from	±	plus or minus the value of
↔	no change, not obvious	+	plus, add, include, and
↑↑	significant/great increase	–	minus, reduce
↓↓	significant/great decrease	≈	approximately
%	percentage	=	equal to, the same as
<	less than	&	and, as well as
>	greater than	*x*°	degrees: e.g. 45°
≥	equal to or greater than	@	in the meridian of
≤	equal to or less than	D	dioptres
?	unknown, questionable	X	axis: e.g. –1.00 X 175. – 1.00D cylinder, axis in 175° meridian
n, n_{sub}, n_{sub}'	refractive indices	Δ	prism dioptres or difference
∝	proportional		

ABBREVIATIONS			
µg	micrograms (.001 g)	min	minute, minutes
µL	microlitres (.001 L)	mL	millilitres (.01L)
µm	microns (.001 mm)	mm	millimetres
µmol	micromoles, micromolar	mmol	millimole, millimolar
cm	centimetres (.01m)	mOsm	milliosmole
d	day, days	nm	nanometres (10^{-9} m)
Endo.	endothelium	Px	patient
Epi.	epithelium	Rx	prescription
h	hour, hours	s	second, seconds
Inf.	inferior	Sup.	superior
kg	kilograms	*t*	thickness
L	litre		

ACRONYMS			
ADP	adenosine diphosphate	LPS	levator palpebrae superioris
ATP	adenosine triphosphate	NADPH	nicotinamide adenine dinucleotide phosphate
ATR	against-the-rule	NIBUT	non-invasive break-up time
BS	best sphere	OD	right eye (Latin: *oculus dexter*)
BUT	break-up time	OO	orbicularis oculi muscle
CCC	central corneal clouding	OS	left eye (Latin: *oculus sinister)*
CCD	charge-coupled device	OU	both eyes (Latin: *oculus uterque* - each eye, or *oculi uterque* - both eyes)
cf.	compared to/with	PD	interpupillary distance
CL	contact lens	PMMA	poly(methyl methacrylate)
Dk	oxygen permeability	R	right
DW	daily wear	R&L	right and left
e.g.	for example (Latin: *exempli gratia*)	RE	right eye
EW	extended wear	RGP	rigid gas permeable
GAG	glycosaminoglycan	SCL	soft contact lens
GPC	giant papillary conjunctivitis	SL	spectacle lens
HCL	hard contact lens	TBUT	tear break-up time
HVID	horizontal visible iris diameter	TCA	tricarboxylic acid
i.e.	that is (Latin: *id est*)	UV	ultraviolet
K	keratometry result	VA	visual acuity
L	left	VVID	vertical visible iris diameter
LE	left eye	WTR	with-the-rule

Summary of Module 4: Examination Procedures for Contact Lens Patients

Course Program

Lecture			Practical Session			Tutorial (Small Group Teaching)		
Title	***Hrs***	***Level****	***Title***	***Hrs***	***Level****	***Title***	***Hrs***	***Level****
L 4.1 The Routine Preliminary Examination	2	1	P 4.1 Preliminary Examination of the Contact Lens Patient	1	1			
L 4.2 Options for Wear Modality and Lens Replacement	2	1						
L 4.3 Lens Dispensing and Patient Education	1	1	P4.3 Insertion and Removal of Contact Lenses	2	1			
L 4.4 Conducting the After-Care Visit	2	1						
L 4.5 Slit-Lamp Examination of the Contact Lens Patient	2	1	P 4.5 Slit-Lamp Examination for Contact Lens Evaluation and After-Care	4	2	T 4.5 Slit-Lamp Examination of Contact Lens Conditions	1	1

* Level 1 = Basic: essential knowledge
Level 2 = Intermediate: desirable knowledge
Level 3 = Advanced: useful knowledge

Course Time Allocation

Level	Lecture	Practical (Laboratory)	Tutorial (Small Group Teaching)	Total Hours
Basic	9	3	1	**13**
Intermediate	0	4	0	**4**
Advanced	0	0	0	**0**
TOTAL	**9**	**5**	**1**	**17**

Request for Feedback

This is the first edition of the IACLE Contact Lens Course, and it is our intention to revise and update it periodically. To ensure each revision is an improvement on its predecessor, we request your help. We invite you to provide feedback in the form of comments, corrections or suggestions which you believe will enhance the accuracy or quality of the Course. Such feedback may then be incorporated in subsequent revisions. We are particularly interested in receiving corrections to, and suggestions for improvements in, the text and slides of the lecture.

To facilitate this feedback process a *pro forma* is included on the next page. This can be photocopied. Please complete your contact details as the team may wish to discuss your suggestions in greater detail or even seek your assistance with any revision resulting from your input.

The IACLE Contact Lens Course
Feedback / Corrections / Suggestions Form

Name: _____ Date: _____
(dd-mm-yy)

Institution: _____

Address: _____

_____

_____

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_____

Module: _____ Unit: _____ Page Number: _____

Slide Code: _____ Section: _____

Comments:

Thank you

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Unit 4.1

(1 Hour)

Lecture 4.1: The Routine Preliminary Examination

Practical 4.1: Preliminary Examination of the Contact Lens Patient

Course Overview

Lecture 4.1: The Routine Preliminary Examination

I. Techniques and Procedures for a Routine Preliminary Examination

II. Measurement of Ocular Parameters

III. Conditions Requiring Special Consideration

Practical 4.1: Preliminary Examination of the Contact Lens Patient

- Preliminary Examination of Students in Pairs
- Proper Recording of Findings
- Choosing the Initial Contact Lenses for Trial Fitting.

Lecture 4.1

(1 Hour)

The Routine Preliminary Examination

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II Conditions Requiring Special Consideration **16**

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I Introduction

1

THE ROUTINE PRELIMINARY EXAMINATION

- Slit-lamp examination of the anterior segment
- Measurement of ocular dimensions
- Assessment of the tears
- Spectacle refraction

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The Routine Preliminary Examination

Following patient screening, a trial fitting is undertaken using criteria relevant to the envisaged wear modality and lens design.

The determination of suitability is based on the findings of standard clinical tests. A thorough history should be taken and the steps outlined in slide 1 are the minimum recommended. Certain conditions may require special consideration and/or examination procedures.

Following a discussion of the preliminary examination, this lecture presents some conditions that may require special consideration.

2

PRELIMINARY EXAMINATION OF THE ANTERIOR SEGMENT

- Eyelids
- Conjunctivitis
- Tears
- Cornea
- Anterior chamber
- Iris and lens

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Slit-Lamp Examination of the Anterior Segment

A routine slit-lamp examination of the anterior segment is necessary to ascertain the existence of any contra-indications to contact lens wear.

Prospective contact lens wearers who prove to be borderline candidates need special assessment. The use of higher magnifications and illumination techniques will better disclose anterior-segment anomalies. The slit-lamp can also be used to assess the tears and measure tear Break-Up-Time (BUT or TBUT).

A systematic slit-lamp examination commences at the most anterior structure and progresses to the most posterior (slide 2) using appropriate illumination techniques (see Unit 4.5 and Module 1, Unit 1.4).

3

BIOMICROSCOPY

Performed:

- Before CL fitting or CL wear, to establish a ‘baseline’
- During trial lens fitting(s) and after-care visits to assess:
  - lens fit
  - any anterior eye changes

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Biomicroscopy is performed before any trial lens fitting to identify possible contra-indications and also to establish a ‘baseline’ for the appearance and condition of the anterior segment *before* lenses are applied. It is repeated during and after the trial fitting to assess the fit and detect any anterior segment changes induced by the lenses.

I.A Measurement of Ocular Dimensions

4

MEASUREMENT OF OCULAR DIMENSIONS

CORNEAL CURVATURE

Consider

- Central and peripheral keratometry
- Corneal topography
- Shape regularity
- Degree of corneal vs internal astigmatism
- Sphere-to-cylinder ratio

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Measurement of Ocular Dimensions: Curvature and Topographic Measurements:

- Central corneal curvature can be measured with a keratometer (ophthalmometer). Measurement accuracy depends on:
  - proper instrument calibration
  - correct eyepiece adjustment (not alterable on all instruments)
  - proper instrument focusing.

  An accuracy of ± 0.02 mm is desired for the mean of three K readings from each of the principal corneal meridians.
- Peripheral corneal shape can be determined with a photokeratoscope or a computerized corneal mapping system (video topographer, corneal topography system, videokeratoscope) (see Module 1, Unit 1.2).
- The regularity and magnitude of corneal and internal astigmatism influence the design of suitable contact lenses. In some cases, a spherical lens provides satisfactory visual acuity when the spherical equivalent of the ocular refraction is incorporated. In the so called 4:1 Rule, a spherical soft lens may be satisfactory in cases where, in the more astigmatic eye, the ocular Rx cylinder is ≤ 25% of the sphere (after Remba, 1979).

NOTE: Module 3, Units 3.3, 3.6 and 3.8 cover astigmatism and its correction in more detail.

5

MEASUREMENT OF OCULAR DIMENSIONS

CORNEA AND PUPIL

Cornea: HVID and VVID

Pupil: Standard room illumination
Low illumination

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Measurement of Ocular Dimensions: Corneal and Pupil Chord Measurements:

- Corneal diameter measurements should include the horizontal and vertical dimensions. This aids the determination of the total diameter (TD) of the initial trial contact lens.
  Measurements are made from limbus to limbus across the central pupil using a suitable millimetre rule. The horizontal and vertical dimensions of the cornea are based on the Horizontal Visible Iris Diameter (HVID) and the Vertical Visible Iris Diameter (VVID) because the transition zone between the cornea and sclera is difficult to discern with the naked eye.
- Measurements of the pupil are made using a millimetre rule. Results acquired under lowered illumination are useful if the possibility of visual disturbances (and field of view restrictions) resulting from a BOZD that is smaller than the pupil (the entrance pupil is some 13% larger than the anatomical pupil), is to be eliminated. Measurements under low illumination are difficult, especially in eyes with dark irides. Several authors suggest the use of a UV lamp (possibly in association with a clear rule with fluorescent markings) as a way of measuring

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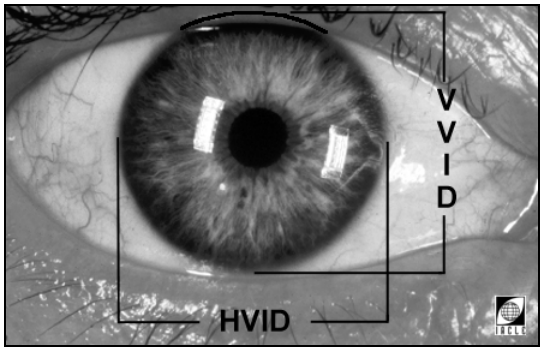

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pupil size under low levels of illumination. Alternatively, a light source, e.g. an ophthalmoscope, can be used to sweep a beam of light across the pupil while holding a pupil gauge (or other suitable measuring scale) close to the eye. As the pupil does not constrict immediately, an accurate assessment of pupil size is possible.

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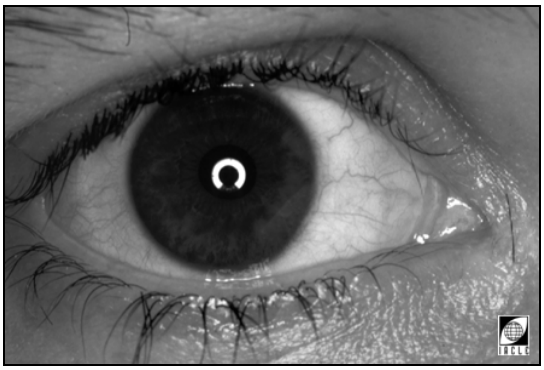

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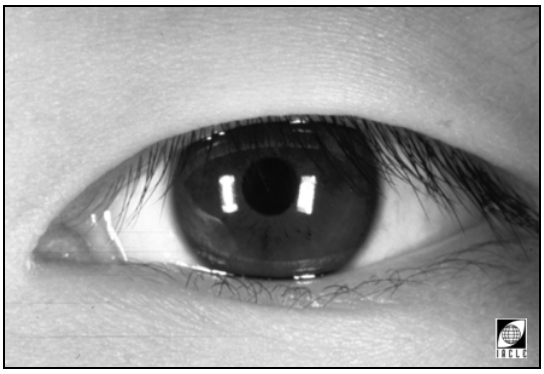

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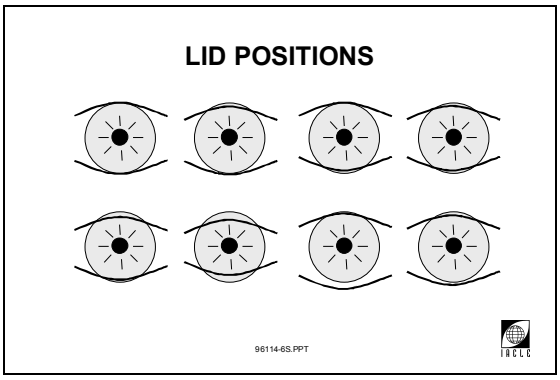

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Measurement of Ocular Dimensions: Assessment of Lid Characteristics

There are significant differences between the lid characteristics of different races, e.g. Caucasian *versus* Asian eyes, especially in terms of the palpebral aperture and lid tension.

Palpebral Aperture (Interpalpebral Aperture)

The palpebral aperture size and shape of Asians are smaller, with a more acute intra-palpebral angle at the inner and outer canthi.

An eyelid feature absent in most Asian races is the longitudinal palpebral fold of the upper lid. In Asians it is common to find the palpebral fold 'tucked' underneath the upper lid (see slide 8) so that the upper lid margin becomes situated behind the skin. This becomes more apparent as the eye ages and the skin 'loosens'.

The possible eyelid-cornea relationships are presented in slide 9. Measurement of the Palpebral Aperture (PA) is made with a millimeter rule from the upper lid margin to the lower lid margin across the centre of the pupil while the eye is in the relaxed primary gaze position (slide 10). Fonn *et al.* (1996) showed that RGP wearers have PAs approximately 0.5 mm smaller than those of non-wearers and soft lens wearers.

Lid Tension

As yet no accurate method of measuring lid tension exists.

Swarbrick & Holden (1996) measured lid tension by:

1. asking the patient to look down;
2. pulling the upper lid outward by grasping the eyelashes gently;
3. subjectively grading the resistance to pulling from +3 (very tight) to –3 (very loose).

For both rigid and soft lenses, lid tension significantly influences lens centration and movement. Higher lid tensions cause greater lens displacement on blinking. Differences of opinion exist concerning the benefits of fitting larger or smaller diameter soft lenses on patients with *tight* lids. A large diameter RGP lens with a thick minus carrier may ride high under a tight upper lid, while a smaller diameter lens may be pushed down. High plus lenses with a thick centre may be

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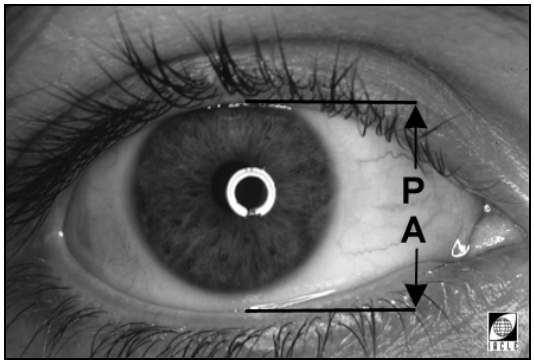

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11

BLINK TYPES

- Partial
- Complete
- Twitch (RGPs only?)
- Forced

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displaced downwards.

Blink Rate

Normal involuntary blinking is a result of tear evaporation and tear film break-up being 'sensed' by the cornea (Collins *et al.*,1989).

An adequate blink rate is necessary to prevent dessication of the ocular surface (Tsubota and Nakamori, 1995). Partial blinking may result in superficial punctate staining of the cornea.

Normal blink rate should be measured during the preliminary slit-lamp examination (a somewhat artificial circumstance) or preferably, whilst talking to the patient without alerting them to what is being done. Awareness may invalidate the results.
An average blink rate of approximately seven blinks per minute is considered normal. The type of blink should also be noted (slide 11). A blink with a twitch is more likely to occur in RGP wearers.

I.B Assessment of the Tear Layer

12

ASSESSMENT OF THE TEAR LAYER

- Invasive
- Non-invasive

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13

ASSESSMENT OF THE TEAR LAYER

- Tear flow
- Volume
- Break-up-time (BUT)
- Osmolality
- pH

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Assessment of the Tear Layer

An important aspect of the preliminary examination is assessment of the integrity of the lacrimal system. Patients who exhibit tear film instability or who have 'dry' eyes (including borderline cases) may not be suitable contact lens candidates.

A variety of invasive and non-invasive techniques have been used to measure the tear characteristics.
Only those techniques applicable clinically will be discussed here:

Invasive techniques usually do not provide realistic measures because of the 'stimulation' involved, e.g. fluorescein instillation may cause reflex tearing. Any measurements made under such circumstances must be treated with suspicion and should be not be regarded as being representative of 'normal'.

Non-invasive techniques attempt to eliminate the stimulation factor. These techniques may still involve instillation of stains (dyes). However, the stains either do not stimulate reflex tearing or their effects can be accounted for in the final assessment.

As yet, a technique that measures *all* aspects of the tears does not exist. Instead, a battery of tests is applied to measure various tear functions separately. An overall assessment can then be made. The tear function tests (invasive and non-invasive) in current use are listed in slides 14 and 19.

14

ASSESSMENT OF THE TEAR LAYER

INVASIVE TECHNIQUES

- Break-Up-Time (BUT)
- Schirmer test
- Phenol-red thread test
- Rose bengal staining

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Assessing the Tear Layer

Invasive Techniques:

- Break-Up-Time (BUT or TBUT).

  BUT can be viewed as a measure of the stability of the tear film (Guillon & Guillon, 1994). The BUT is the time taken (in seconds) for the first break in the tear film ('dry' spot) to appear following a complete blink.

  Fluorescein (a vital stain, Feenstra and Tseng, 1992B) is instilled and the tears observed with a slit-lamp. A Wratten #47 filter or equivalent is used as the 'exciter' filter (blue) over the light source, and a Wratten #12 or equivalent is used as a 'barrier' filter (yellow) over the observation system. The patient is instructed to blink fully and then stop blinking. At this point, the timing commences. The whole of the exposed tear film is observed and the time at which the first break appears is noted. Tear film breaks appear as dark spots or streaks (slide 15) indicating a disruption of the whole tear film.

  While average readings range from 10 - 40 seconds, higher readings are possible. Readings below 10 seconds are suggestive of

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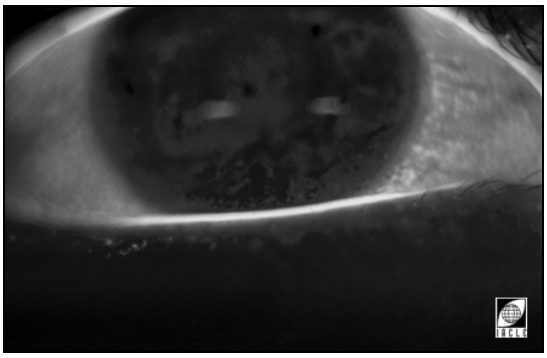

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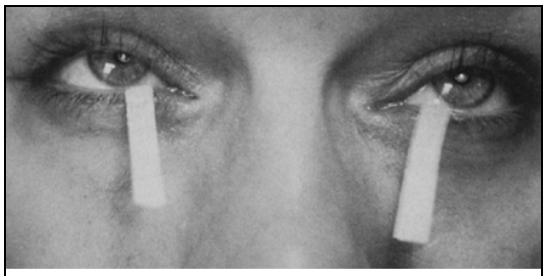

Lowther & Snyder, 1992
Contact Lenses: Procedures & Techniques. 2nd ed.
Fig. 5.27
Butterworth-Heinemann

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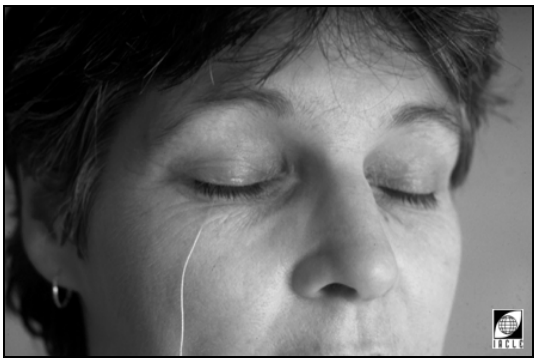

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an abnormal tear film.

- Schirmer test.

  Tear production rates can be assessed using special-purpose sterile filter strips. The filter strips are bent at their notch and 'hooked' over the nasal lower lid margin. The patient is instructed to look up both before insertion of the filter strip and during the 5 min test (slide 16). The analogue of the basal tear volume is the length (in mm) of the wet area of the filter strip measured from the notch. Blinking is permitted during the test.

  The Schirmer test has been widely studied and has been shown to be extremely variable at best and of questionable value at worst. Even 'normal' values range from <5 mm to more than 33 mm of wetting, average 15mm, in 5 minutes. Lengths less than 5 mm in 5 minutes should be viewed with suspicion. However, some workers have suggested that the figure is irrelevant if there is no apparent discomfort or functional abnormality.

- Schirmer II (with anaesthetic)

  This is a modification of the original Schirmer test. A topical anaesthetic is applied and excess tear fluid removed with a cotton swab.

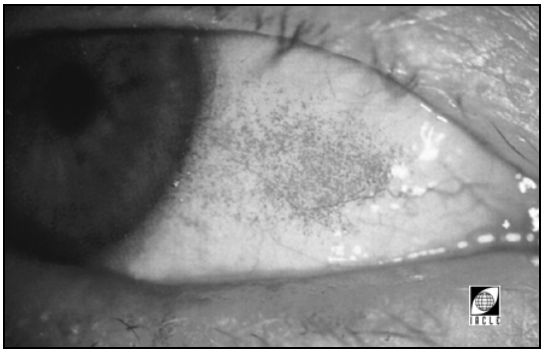
  A filter strip as used in the normal Schirmer test is then inserted for 5 minutes. A normal reading is approximately 10mm in this time.

- Phenol-red thread test (PRT)(Zone-Quick™)

  Primarily, this rapid test assesses basal tear volume. By incorporating the pH-sensitive indicator phenol red (phenolsulphophthalein, a pH-sensitive indicator) in the thread, the tear pH can be determined at the same time.

  A 70 mm length of phenol red-impregnated special 2-ply cotton thread is inserted into the lower temporal cul-de-sac for 15 seconds (slide 17). Eye closure is requested immediately after insertion. The wet length is measured and the colour change noted. Over the pH range 6.6 to 8.2, the colour changes from yellow to red. An average wet length of 16.7 mm in 15 seconds was found for a large population (3780 eyes) of 'normals'. Wet lengths less than 6 mm are indicative of a potential dry eye patient. Minimal reflex tearing is confirmed by similar results being achieved with anaesthetized and unanaesthetized eyes (Hamano *et al.*, 1983). Zone-Quick™ is marketed by Menicon, Nagoya, Japan.

18



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- Rose bengal staining.
  Dry eye patients may have inadequate tear secretion which adversely affects epithelial cells and decreases the protection from rose bengal normally imparted by the tear film. The areas affected may be elicited by instilling a controlled amount of rose bengal stain into the eye(s). A slit-lamp, using diffused white light, will reveal any stained cells as reddish purple areas (slide 18). Rose bengal is available in strips, unit-dose vials or bottles.
  Despite the earlier belief that rose bengal (a fluorescein derivative) is only absorbed by both dead cells and mucus, recent research has shown that it also stains surface epithelial cells either poorly protected, or unprotected, by the preocular tear film. This suggests it should be the ideal tear film, and ocular surface disorder, disclosing agent.

  However, while once viewed as a vital stain, it has now been shown to be cytotoxic and it is probable that this effect may also be the cause of the 'smarting' normally reported when rose bengal is instilled. Exposure to rose bengal leads to morphological changes, loss of cell motility, cell detachment and ultimately, cell death (Feenstra and Tseng, 1992A). Further, a photodynamic property has also been elicited whereby a phototoxic effect follows exposure to light.

  Albumin, mucin and tear substitutes such as carboxycellulose, offer protection from rose bengal staining (Feenstra and Tseng, 1992B).

19

ASSESSMENT OF THE TEAR LAYER

NON-INVASIVE TECHNIQUES

- Non-invasive Tear Break-Up-Time (NIBUT)
- Tear prism height
- Lipid layer evaluation

96114-11S.PPT

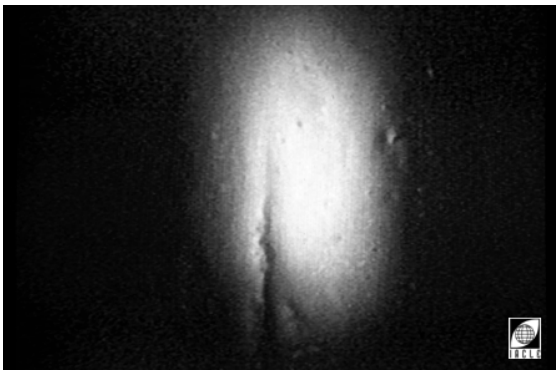
4L196114-11

Assessing the Tear Layer

Non-Invasive Techniques

- Non-Invasive Tear Break-Up-Time (NIBUT).
  To avoid any artefacts resulting from fluorescein instillation, assessment of the BUT can be performed by other means. Either the diffused white light of a slit-lamp or a Tearscope™ can be used to observe the tear film.
  Slide 20 shows a break in the tear film viewed at high magnification. Using a slit-lamp does have some disadvantages. The light source of the slit-lamp generates heat, causing some evaporation of the tear film which may affect the NIBUT. The Tearscope (slide 21) developed and described by Guillon and Guillon (1993) uses a 'cold' light source which allows a truer estimation of the NIBUT.
- Tear Thinning Time (TTT).
  This is a variation of the NIBUT method. A keratometer is used instead of a slit-lamp or a Tearscope. While the blink is held, the keratometer's mire images are observed and

20



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the time of the first disturbance is noted. Any image disturbance is attributed to alterations of the tear film. Shorter times than NIBUT have been reported, suggesting a greater sensitivity to tear film changes. Hirji *et al.* (1989) modified the basic technique by developing a grid for the keratometer.

21

4L11210-93

- Lipid Layer Evaluation.

  As the superficial lipid layer contains a mix of several different lipids, different patterns are formed. Each pattern corresponds to a characteristic lipid layer thickness. Thicker lipid layers are better at preventing evaporation of the aqueous and result in greater tear film stability.

  Using either a Tearscope or diffuse slit-lamp illumination and high magnification, the tear film lipid layer can be examined and an estimate of tear film stability made. The Tearscope is positioned in front of the slit-lamp (set to 20X magnification) close to the patient's eye.

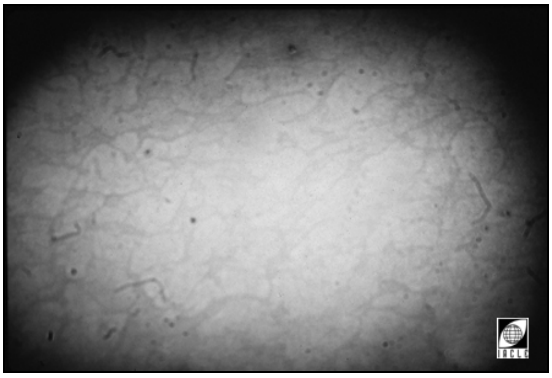
  The Tearscope is focused on the Pre-Ocular Tear Film (POTF) and the patient is asked to blink once. The time taken for a discontinuity in the tear film to appear is measured with a stop watch (in seconds).

  Lipid layer pattern classifications of the POTF, in order of increasing thickness, are illustrated below (Ruben and Guillon, 1994):

  – Open meshwork (≈15nm), slide 22.

  – Closed meshwork (≈30 nm), not shown.

22



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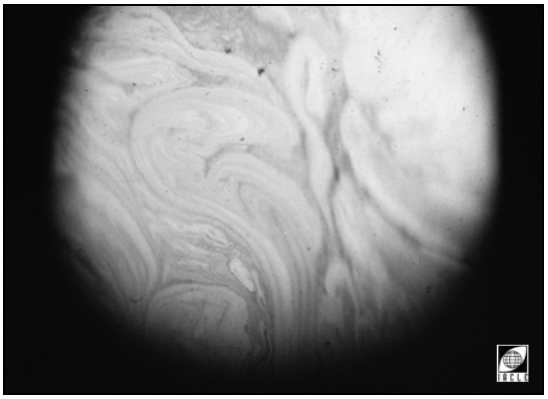

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  – Flow pattern (30 - 80 nm), slide 23.

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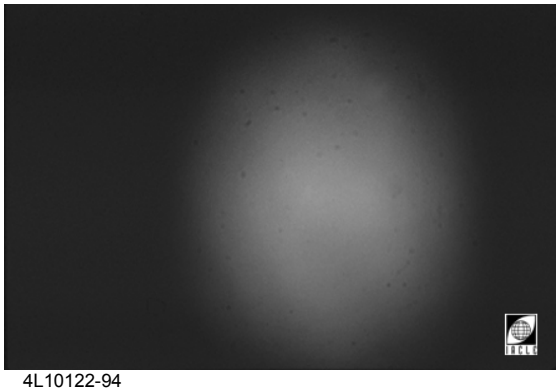

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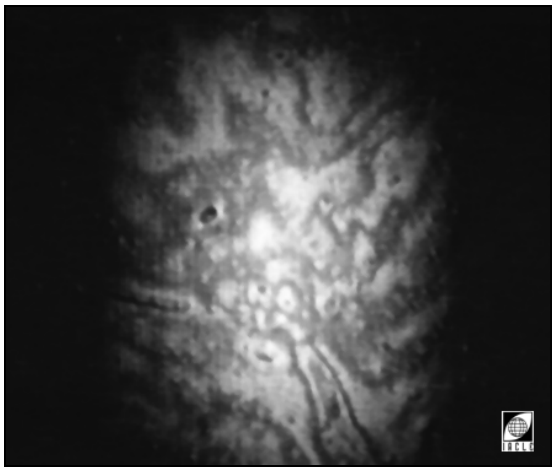
– Amorphous (= 80 nm), slide 24.

25



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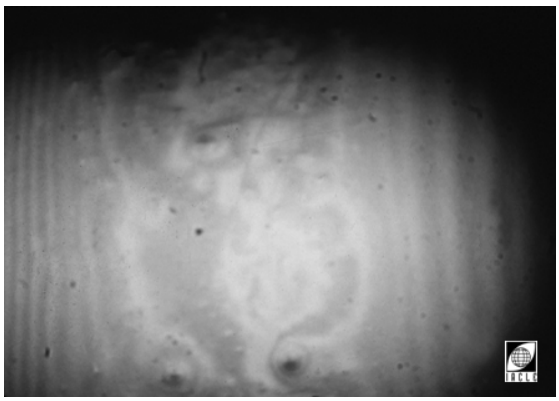
– Coloured fringes (80 - 370 nm), slide 25.

26



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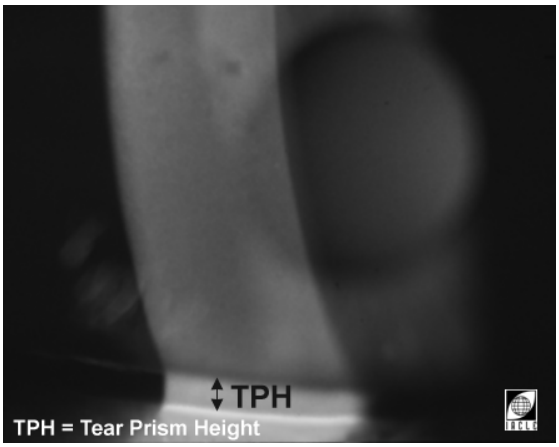
– Combination patterns (variable), slide 26.

Contact lenses alter the stability of the Pre-Lens Tear Film (PLTF). It is thinner than the POTF and will sometimes show a meshwork or flow pattern. When the lipid layer is very thin (open meshwork), the aqueous layer of the tear film is seen as red and blue interference fringes.

27



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- Tear Prism Height.

  Associated with the lower lid margin is a tear reservoir from which the upper lid spreads tears. The sweeping action of the lids spreads a lipid-coated layer of tears over the ocular surface with each blink. The thickness of the tear film depends on tear evaporation, the coefficient of diffusion of various tear components across the cornea and, most importantly, the tear volume.

  The normal tear prism height is an analogue of the tear reservoir volume. It can be measured using an eyepiece graticule suitably calibrated (Swarbrick and Holden, 1996). Slide 27 shows the tear prism (stained with fluorescein for photographic clarity only). Lamberts *et al.* (1979) give normal heights as 0.1 - 0.3 mm and the height associated with dry eye as < 0.1 mm. Other methods of measuring the tear prism height have been proposed and measurements vary from 0.20 mm to 1.0 mm (Port and Asaria, 1990).

I.C Spectacle Plane Refraction

28

SPECTACLE PLANE REFRACTION

- Baseline refraction:
  - Vertex distance
  - Accommodation
  - Convergence
- Subjective vs objective refraction
- Over-refraction

96114-12S.PPT

4L196114-12

Spectacle Plane Refraction

- Baseline refraction is performed at the spectacle plane and includes both subjective and objective determinations (autorefractor, retinoscopy). Issues that have to be considered when determining the contact lens BVP are summarized below and are covered in detail in Unit 2.3.
  - Vertex distance

    The spectacle plane is approximately 12 - 15 mm from the corneal apex. A myope requires less minus power at the cornea than at the spectacle plane, whereas the hyperope requires more plus power than spectacles.

    The effects of vertex distance become clinically insignificant if the refraction at the spectacle plane is less than 4.00 D (see Unit 2.3 for calculations). Note that with astigmatism, calculations of the corneal plane refraction should be based on meridional powers.
  - Accommodation and Convergence

    Myopes have to converge and accommodate more in wearing contact lenses than in spectacles. Conversely, hyperopes have to accommodate and converge less when wearing contact lenses.

    The effects on the ratio of accommodative convergence to accommodation (AC/A) should also be considered. While a myope needs to accommodate more at near in contact lenses, the stimulus to accommodation may be greater due to the greater convergence required with lenses.

    If a myopic incipient presbyope is changed to contact lenses, a problem at near may be precipitated. Conversely, switching a hyperopic incipient presbyope to contact lenses may delay the need for a near Rx.
  - Binocular coordination

    The effects of changing from spectacles to contact lenses on any existing binocular incoordination warrant consideration.

    While it is possible that some changes may be helpful, others will exacerbate pre-existing problems, e.g. an exophoric neophyte contact lens wearer may experience problems at near when wearing contact lenses which are not manifested when wearing spectacles because of the latter's base-in help.

II Conditions Requiring Special Consideration

29

SPECIAL CONSIDERATIONS

- Refractive
- General health
- Ocular conditions
- Medications/therapeutics
- Previous Rxs
- Occupational, recreational and environmental factors

96114-13S.PPT

4L196114-13

Special Considerations

Some patients have conditions that require special consideration during the preliminary examination.

30

SPECIAL CONSIDERATIONS
REFRACTIVE

- High myopia
- Progressive myopia
- High astigmatism
- Keratoconus
- Anisometropia
- Monocular diploma

96114-14S.PPT

4L196114-14

Special Considerations: Refractive:

- High myopia.

  With high myopes the following should be considered:

  – Compensation for vertex distance must be made when any over-refraction result exceeds 4.00D. Ideally, the trial lens BVP should be as close to the final power as possible.

  – Ensure that any high powered trial lens used has a suitably thin edge. This will prevent any discomfort associated with thick edges. This consideration is more important with rigid lenses.

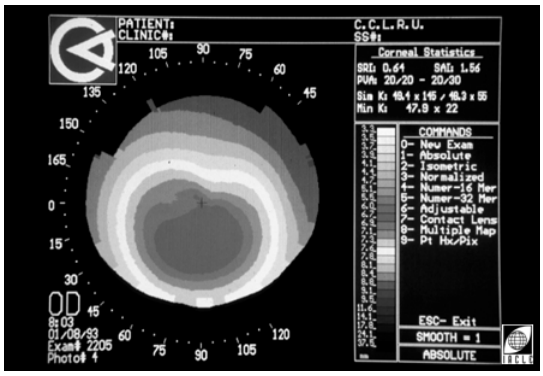
  – The presence of anisometropia and the potentially progressive nature of high myopia should be considered (see below).

- Progressive myopia.

  – Progressive myopes may require potentially expensive relatively frequent alterations in Rx. Some form of disposable lens programme may be an economic way of accounting for frequent Rx changes. RGP lenses can be modified to produce small Rx changes but significant changes will probably require new lenses. Refractive development can be ascertained through a thorough history, previous patient records and referral information.

  – Progressive myopes require more frequent consultations to monitor refractive changes and for contact lens after-care.

31



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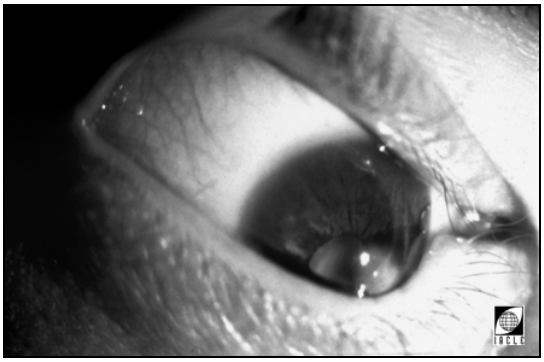

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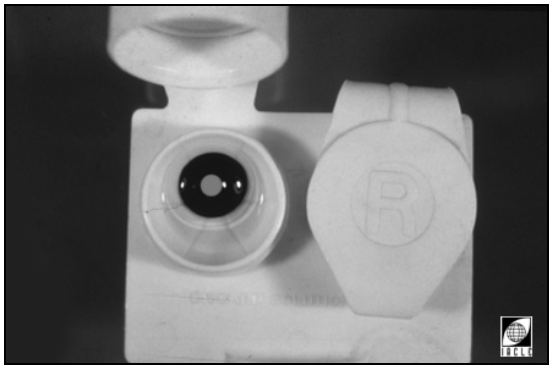

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- High astigmatism.
  - Lenses that correct astigmatism ≥ 0.75 D of astigmatism), should be prescribed unless there are extenuating circumstances (cost, physiological requirements, some amblyopia). High astigmats and ametropes who have had poor visual acuity (VA) for extended periods may be more tolerant of small degrees of residual astigmatism.
- Keratoconus.
  - Spectacle refraction is difficult. An autorefractor may provide a satisfactory starting point.
  - Computerized corneal mapping systems (slide 31) provide a more accurate representation of the topography of a keratoconic cornea (slide 32).
  - It is also prudent to ascertain the type and degree of keratoconus as well as the likelihood of penetrating keratoplasty being required in the foreseeable future.
- High hyperopia.
  - Higher Dk materials and special designs are required to minimize hypoxia because of the thickness of high plus lenses. Providing a lens with the highest Dk/t will reduce (but not eliminate) the negative effects such lenses have on corneal integrity.
- Anisometropia.
  - Contact lenses are usually considered the most suitable form of vision correction when significant differences (>2D) in Rx exist between the eyes. However, the category of the ametropia (axial or refractive) is relevant. As was shown in Unit 2.3, if the anisometropia is refractive in origin, contact lenses are the most suitable form of correction. Conversely, if the ametropias are axial in origin, spectacles are recommended. Unfortunately, it is not usually possible to determine the category in the normal clinical setting. The prismatic imbalance induced when spectacles of very different powers are worn is also eliminated with contact lent lenses. For more details see Unit 2.3.
- Monocular diplopia.

  Polycoria (multiple pupils in one iris) can cause monocular diplopia. This condition can be alleviated by prescribing opaque cosmetic lenses with a clear pupil (slide 33). Additionally, the possibility of monocular diplopia being caused by keratoconus should not be overlooked.

34

SPECIAL CONSIDERATIONS

GENERAL HEALTH

- Diabetes (moderate to severe; managed with daily insulin
- Allergies
- Arthritis
- Pregnancy
- Sinus problems

96114-15S.PPT

4L196114-15

35

THE DIABETIC CORNEA

- Superficial punctuate keratopathy
- Recurrent corneal erosions
- Persistent epithelial defects
- Neurotrophic ulcers
- Striae
- Stress (e.g. CLs or corneal surgery) may precipitate the above

96114-16S.PPT

4L196114-16

36

INITIAL EYE EXAMINATION OF THE DIABETIC PATIENT

- Comprehensive ocular and general history
- Assesment of medical status (blood pressure and blood glucose) and compliance with therapy
- Measurement of visual acuity
- Refraction
- Tonometry and biomicroscopy
- Ophthalmoscopy with mydriasis
- Patient health education
- Appropriate reporting to other health care professionals

96114-17S.PPT

4L196114-17

37

ALLERGY SYMPTOMS EXACERBATED BY CONTACT LENSES & PRESERVED SOLUTIONS

- Redness
- Discomfort (dry, gritty, itchy)
- Lid problems

96114-18S.PPT

4L196114-18

Special Considerations: General Health:

The fitting of contact lenses to patients with general debility or a systemic disease should be approached with caution and careful consideration given to the likely effects of lens wear. Therapeutic lenses may be fitted to alleviate symptoms that accompany some conditions.

These conditions include:

- Diabetes (moderate to severe: daily insulin required).

  Diabetes mellitus is a metabolic disorder caused by insulin deficiency. Carbohydrate utilization is reduced and lipid and protein enhanced (Stedman, 1987).

  Decreased low contrast visual activity without any apparent loss of 'normal' visual acuity has been reported by several authors (Hyvärinen et al., 1982; Regan and Neima, 1984). Diabetic corneas are characterized as having decreased sensitivity, stromal oedema and punctate corneal staining. They are prone to ulceration, infection and poor healing. These are usually contraindications to the fitting of contact lenses. The effects of diabetes on the cornea are presented in slide 35.

  Mild diabetics can be fitted with lenses if the cornea is closely monitored. In a study of diabetic rabbit corneas by Herse (1990), recovery from contact lens-induced oedema was significantly lower than normal in both open and closed eye conditions. This study suggests caution in prescribing extended wear contact lenses for diabetics.

  A record of insulin dosage helps establish a possible association between corneal changes and insulin intake. Slide 36 presents a listing of the steps suggested for an initial eye examination for diabetics (American Optometric - Association, 1987).

- Allergies.

  Common antigens (allergens) are dust, dust mites, animal fur, airborne pollens, food additives, drugs, etc. Asthmatic patients are often also more allergic generally. Where possible, specific antigens should be identified, especially if they are lens care product-related. Symptoms exacerbated by contact lenses and preserved solutions are listed in slide 37.

  Patients with allergies can be fitted with contact lenses, but may require more frequent after-care. Monitoring the progression of symptoms is of primary importance during the early after-care examinations.

38

4L10204-97

39

OCULAR EFFECTS OF PREGNANCY

- Steepening of corneal curvature
- Decreased corneal sensitivity
- Increased corneal thickness
- Possible conjunctival oedema and subconjunctival haemorrhage
- Lid oedema

96114-19S.PPT

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40

OCULAR EFFECTS OF PREGNANCY

- Reduction in: tear volume, lacrimation and tear BUT
- Shift towards myopia
- Minor reduction in amplitude of accommodation, near point of convergance and AC/A
- Low incidence of Krukenburg Spindle (melanin deposits in posterior cornea)

96114-20S.PPT

4L196114-20

41

SINUS PROBLEMS

- Require frequent after-care
- Prone to discomfort and excessive tearing

96114-21S.PPT

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- Arthritis.

  Various types of arthritis have ocular manifestations (Kanski, 1988a and 1988b):

  – Reiter's disease
  – Ankylosing Spondylitis (AS)
  – Juvenile Chronic Arthritis (JCA)
  – Rheumatoid Arthritis (RA).

  The first three are associated with 20 to 30% of acute attacks of iritis. In the case of JCA, the attack is asymptomatic, indicating the need for regular slit-lamp biomicroscopy to monitor any changes in the anterior chamber. RA is a systemic and progressive inflammatory condition of the joints of the hands and feet. RA makes lens handling, insertion and removal of contact lenses and opening solution bottles difficult. Family members can assist older patients with the care and maintenance of their contact lenses.

  Ocular manifestations of RA include keratoconjunctivitis sicca, keratitis and scleritis. Lubricants are necessary to alleviate symptoms of dry eyes. Frequent after-care is also indicated.

- Pregnancy.

  Pregnancy brings about hormonal and systemic changes that can affect the metabolic processes of the cornea. Oestrogen and progesterone levels increase, causing salt and water retention. Pregnant women have an average weight gain of 12 kg. Oxygen intake increases by 15%. Ocular effects (Imafidon and Imafidon, 1991; Manges et al., 1987; Carlson, 1988) are listed on slides 39 and 40.

  Because the retention of water swells the cornea and may also alter its curvature, new patients are best fitted after pregnancy and when corneal curvature has stablized.

  Current wearers need not stop wearing their lenses, provided they remain problem-free. If fitting or other problems occur, refitting, or even cessation of wear, needs to be considered.

- Sinus Problems.

  Sinusitis is an inflammatory condition of the mucous membrane lining the paranasal sinus. Patients with sinus problems may be fitted with contact lenses but require frequent after-care. Patients may report discomfort and excessive tearing.

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OCULAR CONDITIONS REQUIRING CAUTION

- Allergies
- Active eye disease
- Susceptability to infections
- Dryness of eyes
- Conjunctival swelling and redness
- Photophobia

96114-22S.PPT

4L196114-22

Special Considerations: Ocular Conditions:

The existence of an ocular condition may mean either the patient should not be fitted at all or a special type of lens may be required. Some possible conditions are shown in Slide 42.

Generally, a patient with an active eye disease should not be fitted with contact lenses until the condition has resolved.

Patients without ocular pathology but with either a susceptibility to, or a history of, eye disease, are best fitted with high Dk RGP or disposable contact lenses worn on a daily wear basis. Wearing time may have to be limited. Care regimens should be tailored to the patient's condition and should probably be preservative-free. Frequent after-care visits are advisable.

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SPECIAL CONSIDERATIONS

MEDICATIONS/THERAPEUTICS

- Ocular
- Systemic
- Topical

96114-23S.PPT

4L196114-23

Special Considerations: Medications

Patients may be on one or more medications at the time of their consultation. Some drugs may have ocular side-effects. Other effects may include the need for alterations in lens fitting, wearing schedule, or even care regimen. Contact lens fitting may be contraindicated until after the course of medication is completed. Some of the components of the medication may be absorbed by hydrogel lenses through the tear film.

- Ocular medications are available in several forms:
  - ointments

    Because of an ointment's high viscosity, the absorption of its active ingredient(s) by ocular tissue is slow. However, it offers the benefits of a longer action time than liquid forms. Ointment on the surface of a contact lens can affect lens wettability, and this may cause visual disturbances. More frequent lens removal and cleaning may be necessary. Disposable contact lenses are ideal for patients who require regular applications of ointment.
  - eyedrops

    While liquid formulations are generally more easily absorbed by soft contact lenses than other forms of ophthalmic medication, they are less likely to be absorbed because of eyedrops' short residence time on the anterior eye. This is especially so if the tear volume and flow rates are normal, since any excess tear volume drains rapidly from the anterior eye. SCLs are best inserted one hour after instilling eyedrops.
  - lotions/creams

    Like ointments, lotions or creams applied to the lids near the margins can affect contact lenses by coating them and affecting their wettability. Lenses inserted after application of lotions or creams will not become

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4L10147-92

contaminated as long as the hands have been washed and the lenses are not allowed to contact the lids.

– ocular inserts

Ocuserts™, ocular inserts with dissolving-membranes or hydrogel-based drug reservoirs are valuable for patients needing time-release or controlled-dose ocular medications for conditions such as glaucoma, dry eye, etc. Disposable contact lenses are also recommended for these patients.

- Systemic.

  Some systemic drugs such as diuretics and beta blockers for heart disease can cause ocular side effects and, therefore, are a contra-indication for contact lenses.

- Topical.

  Some drugs applied as transdermal skin patches (e.g. hyoscine for motion sickness) may cause some dilation of the pupils, blurring of vision, raised IOP and lid irritation. While no difficulties with contact lens wear have been reported, any effects on the eyes or vision are more likely to be attributed to contact lenses than a non-ocular pharmaceutical.

45

CONTACT LENS HISTORY

- Current contact lens wearer
- Previous contact lens wearer

96114-24S.PPT

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Special Considerations: Contact Lens History

Patients may be current, previous or failed contact lens wearers. Refitting success is dependent on understanding the original problems and/or causes of failure. Outlining the differential advantages of a new lens/fitting is essential for informing the patient of the benefits to be derived and the expectations they should have.

46

SPECIAL CONSIDERATIONS

OCCUPATIONAL, RECREATIONAL AND ENVIRONMENTAL FACTORS

- Sports
- Hobbies
- Environmental exposure

96114-25S.PPT

4L196114-25

Special Considerations: Occupational, Recreational and Environmental Factors

- An assessment of each prospective contact lens wearer's activities provides the practitioner with a better understanding of the factors that warrant attention when fitting contact lenses.Sports activities have special ocular requirements and demands. These are discussed in detail in Module 9.
- Hobbies such as sewing or reading have different demands to cooking or gardening. Patients requiring some form of reading correction may be fitted with bifocal contact lenses. However, these are not always available and may not suit all wearers. Alternatively, a patient may be advised to wear monovision contact lenses or reading glasses over distance contact lenses. Commonly, demanding tasks

such as needlecraft, electronic assembly, small equipment servicing, etc. which place high demands on near acuity and/or stereopsis, are often found to be unsuitable to monovision's compromises.

- Exposure to environmental factors may determine the type of contact lenses to be fitted. A patient who is exposed to dust routinely may experience serious discomfort with rigid lenses. Patients who work with chemicals may experience stinging and irritation when wearing SCLs because of the permeation of chemical vapours or fumes into/through the lens.

III Final Evaluation

47

FINAL EVALUATION

Decision is made on specific lens type to trial fit

96114-26S.PPT

4L196114-26

Final Evaluation

The final evaluation is the last phase of the preliminary examination prior to a trial lens fitting. During this phase, the decision to proceed to a trial of a specific type of lens is made based on the absence of major contra-indications. By this stage, the following information should be to hand:

- There are no abnormalities of the anterior segment that predispose the patient to complications with contact lens wear.
- All parameters essential for a trial fitting are recorded.
- Tear volume and stability are satisfactory.
- Corneal plane refraction suggests that contact lenses are available in the powers required.

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FINAL EVALUATION

Consult with patient to determine specific needs

96114-27S.PPT

4L196114-27

Final Evaluation: Patient Consultation

Once the patient's candidature for contact lens wear has been confirmed, their specific requirements need to be ascertained. In so doing, decisions on the lens type and the trial protocol can be made.

Specific needs may vary according to:

- Visual demands.

  For example, a presbyope may have greater demands for intermediate distance (computer work, drafting, etc.) than reading distance.
- Convenience.

  For example, a frequent traveller may find it inconvenient to carry many solutions.
- Flexibility.

  For example, a patient may find the convenience of disposable SCLs ideal for recreational purposes (swimming, orienteering, mountaineering, etc.).
- Individual ocular characteristics.

  For example, unpreserved solutions may lessen the risk of sensitivity reactions.

Patients who express concern about wearing, handling or lens care must be counselled carefully to ensure success.

Practical 4.1

(1 Hour)

Preliminary Examination of the Contact Lens Patient

Practical Session 1

Instructions. Students working in pairs are to conduct a preliminary examination of each other. All findings of the investigation and examination tests listed below are to be written on the Record Form provided.

1. Case history
2. Measurement of ocular parameters
3. Slit-lamp biomicroscopy
4. Recommended/existing lens parameters/design

Practical Session 2

Instruction. After conducting the tests in Practical Session 1, students should try to determine the initial lens of choice for a trial contact lens fitting of their partners and list the specifications on the Record Form.

Contact Lens Preliminary Examination

Surname: _____ D.O.B. / / ☐ M ☐ F File No. _____ Date: _____

Home Address: _____ Hm. _____ Wk. _____

SECTION A: History and Contra-indications

Reasons for Contact Lenses	Yes	No
Cosmetic	☐	☐
Inconvenience of Glasses	☐	☐
Sports and Recreation	☐	☐
Occupation	☐	☐
High Rx	☐	☐
Increased VA	☐	☐
Astigmatism	☐	☐
Aniseikonia	☐	☐
Aphakia	☐	☐
Keratoconus	☐	☐

Medical History	Yes	No
Allergies	☐	☐
Sinusitis	☐	☐
Hayfever	☐	☐
Dryness of Mouth, Eyes, or Mucous Membranes	☐	☐
Convulsions/Epilepsy	☐	☐
Fainting Spells	☐	☐
Diabetic	☐	☐
Pregnant	☐	☐
Psychiatric Treatment	☐	☐
Thyroid Imbalance	☐	☐

Additional Information

Medical	Yes	No
Diuretic	☐	☐
Anti-Convulsant	☐	☐
Tranquilizers	☐	☐
Anithistamines	☐	☐
Contraceptive Pill	☐	☐
Other	☐	☐
Other (if yes see file)	☐	☐

Do you plan to be in the this area for at least 6 months ? Yes ☐ No ☐ Have you worn contact lenses before ? Yes ☐ No ☐

If yes, what was the reason for discontinuing ? _____

SECTION B: Ocular Exam Without Lenses

Uncorrected V.A. OD 6/____ OS 6/____ OU 6/____

Sphero-cylindrical Refraction and V.A (Balanced)

OD ____ ± ____ Sphere / – ____ Cylinder X ____ Axis 6/____ V.A. 6/____ OU

OS ____ ____ / – ____ X ____ 6/____

Keratometry

OD ____ D ____ Horizontal mm @ ____ / ____ D ____ Vertical mm @ ____

OS ____ D ____ mm @ ____ / ____ D ____ mm @ ____

Slit-Lamp Are there any positive Slit-Lamp Findings? OD Yes ☐ No ☐ OS Yes ☐ No ☐

If yes, please complete Slit-Lamp Form

Binocular Vision Status at Distance ☐ Near ☐

Tear Break-Up Time OD ____ Sec. OS ____ Sec.

Diameter (mm)	Fissure	Cornea	Pupil
OD	____	____	____
OS	____	____	____

Lid Tension
Tight ☐
Loose ☐
Medium ☐

Schirmer Tear Test		OD	OS
Hypersecretor	17mm/0-15	Sec. ____	____
Normal	17mm/30-200	Sec. ____	____
Subnormal	17mm/214-300	Sec. ____	____
Hyposecretor	4-16mm/300+	Sec. ____	____

Pachometry: OD ____ mm OS ____ mm

Preliminary Evaluation

Motivation: High ☐ Moderate ☐ Low ☐

Suitability: Yes ☐ No ☐ If No, please detail

Student _____ Supervising Clinician _____

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Modified from an original in use at the School of Optometry, University of Waterloo, Canada

Slit-Lamp Examination Form

Visit Date ____ ____ ____

Clinician: _____ Patient: _____

Last name First name Last name First name

Unless an eye is marked 'ALL NEGATIVE,' each category must be marked by grade
Use an "X" in proper box and note locations of findings on diagrams

SECTION A: Slit Lamp Examination

OD ☐ All Negative OS ☐ All Negative

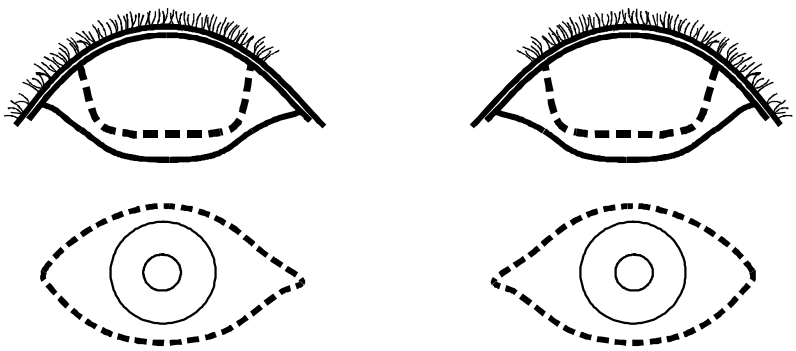
Absent	☐	Present			☐	Corneal Striae	Absent	☐	Present		☐
Grade	0	1	2	3		Corneal Oedema	Grade	0	1	2	3
Grade	0	1	2	3		Corneal Neovascularization	Grade	0	1	2	3
Grade	0	1	2	3		3 and/or 9 o'clock Corneal Staining	Grade	0	1	2	3
Grade	0	1	2	3		Other Corneal Staining	Grade	0	1	2	3
Grade	0	1	2	3		Epithalial Microcysts	Grade	0	1	2	3
Grade	0	1	2	3		Limbal Injection	Grade	0	1	2	3
Grade	0	1	2	3		Bulbar Injection	Grade	0	1	2	3
Grade	0	1	2	3		Bulbar Oedema	Grade	0	1	2	3
Type	0	1	2	3		Tarsal Conjunctival Abnormalities	Type	0	1	2	3

SECTION B: Other Anterior Segment Abnormalities

OD ☐ All Absent OS ☐ All Absent

Instructions: If abnormalities are present, indicate cause(s) by checking appropriate box(es) and note location in diagram below

(1) Lens Related	(2) Solution Related	(3) Result of Other Factors (explain)		(1) Lens Related	(2) Solution Related	(3) Result of Other Factors (explain)
☐	☐	☐ _____	1. Blepharitis	☐	☐	☐ _____
☐	☐	☐ _____	2. Corneal Infiltrates	☐	☐	☐ _____
☐	☐	☐ _____	3. Iritis	☐	☐	☐ _____
☐	☐	☐ _____	4. Corneal Ulceration Confirmed By Microbiological Culture	☐	☐	☐ _____
☐	☐	☐ _____	5. Other (Explain)	☐	☐	☐ _____



SECTION C: Comments

Clinician's Signature _____

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Unit 4.2

(2 Hours)

Lecture 4.2: Options for Wear Modality and Lens Replacement

Course Overview

Lecture 4.2: Options for Wear Modality and Lens Replacement

I. Classification of Lens Wear Modalities and Replacement Schedules

II. Ocular Considerations in Fitting Daily Wear (DW) and Extended Wear (EW) Lenses

III. Success Criteria for Contact Lens Wear

IV. Choosing the Lens Wear Modality and Replacement Schedule

Lecture 4.2

(2 Hour)

Options for Wear Modality and Lens Replacement

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II Ocular Considerations for DW versus EW.....37
III Selecting a Lens Type 42
IV Choosing a Lens Wear Modality.....49
V Choosing a Lens Replacement Schedule.....50

I Classification of Wear Modalities and Lens Replacement Schedules

1

CLASSIFICATION OF WEAR MODALITIES

- Daily wear
- Flexible wear
- Extended wear
- Continuous wear

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Classification of Wear Modalities

Various programmes of lens wear may be recommended by practitioners:

- Daily wear (DW).

  Daily wear is defined as the wearing of contact lenses while the eyes are open. The lenses are inserted some time after awakening from sleep and are removed some time before the next sleep period.

- Flexible wear (FW).

  Flexible wear is daily wear interspersed with *occasional* overnight wear. Traditionally, FW refers to a maximum of two or three nights of wear (during sleep) per week, not necessarily consecutively.

- Extended wear (EW).

  Extended wear refers to uninterrupted wear of contact lenses throughout the day and night, usually extending to one week. After the seventh *day* the lenses are removed for cleaning and disinfection, then reinserted the next morning for a further week of EW. If disposable lenses are used, no cleaning or disinfection is required at the end of the one week wearing cycle, as new lenses are inserted each week.

- Continuous wear (CW).

  Continuous wear refers to the use of contact lenses throughout the day and night for an extended period, usually of between one week and one month. Lens removal, cleaning and overnight disinfection are performed at the end of the period of continuous wear. If disposable lenses are used, no disinfection or cleaning is required at the end of the one month period.

The length of time that contact lenses can be worn is individually variable and depends on the interaction of many factors not all of which are well understood.

2

CLASSIFICATION OF LENS REPLACEMENT SCHEDULES

RGP: As needed
Frequent replacement

SCL: Conventional
Frequent replacement
Disposable
Daily disposable

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Classification of Lens Replacement Schedules

Contact lenses are generally replaced on the basis of two conditions. These are:

- Lens age and degree of contamination and/or damage.
- As a preventive measure against ocular complications.

An RGP contact lens can be used for up to 2-3 years providing hard deposits, warpage, crazing, permanent scratches and cracks do not develop or large Rx changes do not become necessary. Because of their longer life span, RGP lenses are more economical than SCLs in the long term.

The higher oxygen permeability of most RGP materials make them more suitable for EW than SCLs. RGPs used for EW should be replaced more frequently than

those used for flexible or daily wear.

Due to their hydrophilic nature, SCLs are more susceptible to deposit formation and microbial contamination than RGPs. Lens replacement schedules may vary from one individual to the next. SCL replacement schedule classifications are:

- Conventional.

  Conventional lenses are lenses which are not replaced until either their expected longer life-span has been reached or their usefulness is terminated prematurely by damage or deposits. Lens replacement usually occurs at about twelve months providing a complete care regimen, including enzymatic cleaning, has been used.

- Frequent replacement.

  Frequent replacement (planned replacement, programmed replacement) refers to a 1-3 month schedule of lens replacement using a complete care regimen including enzymatic cleaning.

- Disposable.

  Disposable lens wear refers to a schedule of weekly or fortnightly lens replacement while using a care regimen which does not usually include enzymatic cleaning.

- Daily disposable.

  Daily disposable lenses are lenses discarded after each period of wear (usually a day). A new pair is inserted for the following period of wear (usually beginning the next morning). No lens care is required. These are true disposable lenses because they are ‘single-use’ products.

Frequent replacement and disposable lenses can be categorized as frequent or planned replacement with the schedule varying according to patient requirements and characteristics as well as success of lens wear.

More recently, planned replacement programmes for RGP lenses have been introduced as a step towards preventative eyecare for the RGP contact lens wearer, e.g. MaximEyes by Paragon Vision Sciences. Other manufacturers are likely to follow.

II Ocular Considerations for DW *versus* EW

3

DW *vs* EW
CONSIDERATIONS

- Corneal status
- Risk factors
- Rx
- Tear film
- Lid integrity
- Environmental factors
- Individual characteristics

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Ocular Considerations for DW *versus* EW

The soft and rigid contact lenses available currently differ significantly in their material properties, designs, on-eye dynamics and fitting requirements. Along with individual ocular differences, e.g. metabolic requirements and corneal health, lens characteristics help determine whether contact lenses may be worn on a daily (DW) or extended wear (EW) basis. Important considerations in prescribing DW or EW contact lenses are listed opposite.

For simplicity, lens wear modalities will be categorized generally as DW or EW (including FW and CW) in the following discussion unless otherwise stated.

4

DW *vs* EW
CORNEAL STATUS

- If apparently normal
  - DW
  - EW
- If signs of compromise apparent
  - DW only

97732-4S.PPT

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Corneal Status

Contact lenses induce metabolic changes that may affect the anterior eye in various ways. The ability of the eye in general, and the cornea in particular, to sustain such changes must be ascertained before contact lens wear proper commences.

- If, after a comprehensive examination, the cornea is clear and apparently normal, *prima facie* the eye is suitable for either daily wear or extended wear contact lenses.
- If the cornea exhibits any signs of compromise (past or present), EW should be excluded from the list of options considered or offered.

Signs may include corneal distortion, scars or opacities, infiltrates, epithelial microcysts, vacuoles, polymegethism, vascularization (corneal or limbal), keratic precipitates, etc.

In most cases in which signs of compromise are detected, DW, rather than EW or FW should be the wear modality of choice.

5

DW *vs* EW
RISK FACTORS

- Corneal oedema
- Loss of corneal sensitivity
- Lens adherence
- Inflammation and infection

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Risk Factors: DW *versus* EW

Many controlled and post hoc studies of the risks of DW and EW have been conducted. However the different methodologies, populations and lenses involved make comparisons extremely difficult or even impossible. The majority of studies have focused on SCL EW.

There is general agreement that, compared with DW, EW increases the risk of contact lens complications by between two and six times (Weissman *et al.,* 1987, Schein *et al.*, 1989, Benjamin, 1991, MacRae *et al.,* 1991, Brennan and Coles, 1997).

Further, the risks involved in EW increase with each additional consecutive night of wear (Schein *et al.,* 1989).

It is probable that both practitioners and patients must accept that not all those seeking EW can or will be successful in EW (Benjamin, 1991).

6

DW *vs* EW
INFECTIOUS KERATITIS AND STERILE INFILTRATIVE KERATITIS

Similar incidence in:

- Disposable and conventional lenses

Greater incidence in:

- Extended wear (esp. soft)

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Complications arising from contact lens use are partially attributable to the physiological limitations of lenses currently available. Other factors such as lens contamination, poor lens care compliance, microbial agents and tear stagnation may also have a role in risk determination.

Originally, it was hoped that disposable lenses would address the bulk of problems that were not oxygen transmissibility-dependent. Unfortunately, this has not proved to be the case (Poggio and Abelson, 1993, Guillon *et al.,* 1994). This suggests that replacement scheme is not a major factor in their aetiology. However, Holden *et al.* (1987) showed fewer lens-induced effects overall in lenses which are more frequently removed and replaced.

EW: SCL and RGP

Useful studies comparing problem rates with SCL and RGP lens EW are rare, largely because RGP EW is uncommon and rigorous studies are difficult and expensive to undertake.

One of the attractions of RGP lenses is their greater oxygen transmissibility. However, while many studies suggest that corneal hypoxia in EW is associated with infectious keratitis, absolute proof is still lacking (Brennan and Coles, 1997).

Some studies have shown that RGP EW is safer than SCL EW (e.g. Benjamin, 1991, Maehara and Kastl, 1994). By analysing the limited data available, Benjamin (1991) concluded that:

- RGP EW is 'twice as safe' as SCL EW (0.42% *versus* 0.88% ulcer rate, per patient, per year.
- RGP EW is 'half as safe' as SCL DW.

Not all data published supports the assertion that the incidence of *adverse responses* in RGP EW is lower than SCL EW, e.g. MacRae *et al.,* 1991, Brennan and Coles, 1997. Further, few attempt to rate the severity of the final outcome of adverse responses by either lens type or wear modality, making comparisons, beyond mere incidence rates, difficult.

RGP lens adherence, which occurs in 95% of wearers at least occasionally (Swarbrick, 1991), should probably not be considered an adverse response in most instances.

7

DW *vs* EW

Rx factors:

- *Average* thickness of plus or minus lenses
- Oxygen demands under specific conditions
- Corneal changes induced by EW
- Visual acuity changes

97732-12S.PPT

4L297732-12

Prescription

When deliberating on the DW *versus* EW issue, a number of additional factors need to be considered:

- Average thickness of plus or minus lenses. Increased centre and mid-peripheral thicknesses with high plus and minus power, respectively, cause greater corneal swelling. However, in assessing the swelling response, the average lens thickness was recommended as the basis for determining the oxygen transmission across the lens surface (Holden *et al*., 1983; Wechsler, 1985). The greater average thicknesses of the lenses required to correct the higher ametropias (+ or –) necessitate materials with higher oxygen permeabilities to attain the required lens oxygen transmission.
- Oxygen demands under specific conditions.

8

MINIMUM Dk/t_{av} REQUIREMENT

DW: 24.1 x 10^{-9} (cm x m/O_2)/(s x ml x mm Hg)

EW: 87.0 x 10^{-9} (cm x m/O_2)/(s x ml x mm Hg)

34.3 x 10^{-9} (cm x m/O_2)/(s x ml x mm Hg)

Holden & Mertz, 1984

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Based on a normal population of subjects, the minimum Dk/t_{av} requirement for SCL DW is 24.1 x 10^{-9} units and 87.0 x 10^{-9} units for EW (Holden and Mertz, 1984) which limits the overnight corneal swelling to 4% and does not include any DW swelling. No SCL material currently available can meet these EW criteria. However, a compromise Dk/t_{av} of 34.3 x 10^{-9} units is recommended to limit overnight swelling to 8%.

9

DW *vs* EW
TEAR FILM

- Signs of dry eye
- Debris
- Excess lipid

97732-14S.PPT

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Tear Film

The quality of the tears/tear film is an important consideration when selecting lens type and wear schedule.

Dry eye and marginal dry eye patients have a thinner tear film and/or reduced tear volume which contra-indicate EW.

The choice of SCL water content is a controversial subject. While many suggest that, based on experience, conventional high water materials are contra-indicated in dry eye, others, equally experienced, suggest the opposite. It would seem therefore that lenses at either end of the water-content scale could be trialled and, in the event of problems being encountered, lenses at the other end of the scale evaluated.

Recently, several manufacturers have released high water materials or complete lenses which it is claimed, demonstrate an increased resistance to the bulk flow of water. Should problems arise with conventional materials these materials may be helpful.

In some cases, RGP lenses may be the preferred option.

10

DW *vs* EW
LID INTEGRITY

- Prominent papillae and/or follicles
- Redness

97732-15S.PPT

4L297732-15

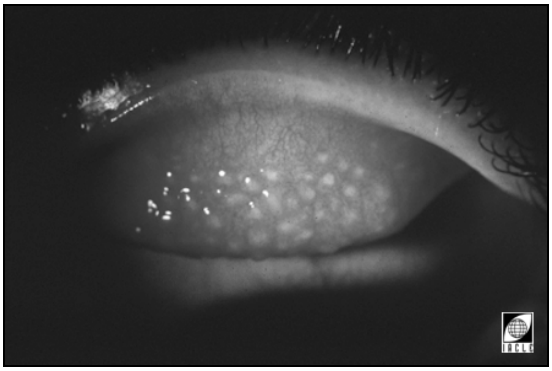
Lid Integrity

A thorough lid evaluation is central to selecting both the type of contact lens and the most suitable wearing schedule. Signs of redness and roughness of the tarsal conjunctiva in a non-wearer should alert the practitioner to possible problems associated with lens wear (RGP or SCL).

Contact lens-induced lid changes have been reported in both DW and EW. Contact Lens-related Papillary Conjunctivitis (CLPC) is occasionally observed on the palpebral conjunctiva of the upper lid and is characterized by redness and an increase in number, or change in size, of papillae. The incidence of CLPC is greater in EW and higher for SCL wearers than RGP wearers.

In studying the incidence and onset of Giant Papillary Conjunctivitis (GPC), the frequency of SCL replacement rather than wear modality seems to be an aetiological factor (Spring, 1974;

11



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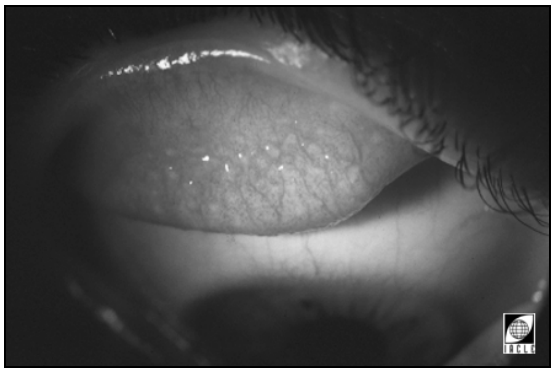

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Allansmith *et al*., 1977, Kotow *et al*., 1987). This means that frequent replacement SCLs and RGP lenses are more likely to prevent the development of lid changes or resolve existing conditions (Grant, 1991). Slide 11 shows palpebral redness and enlarged papillae characteristic of advanced GPC which developed after several years of SCL wear. Slide 12 shows significant resolution of the condition six months after commencing RGP contact lens wear.

13

DW *vs* EW

ENVIRONMENTAL AND OCCUPATIONAL FACTORS

- Exposure to gas, fumes, chemicals and pollutants
- Nature of work
- The infrequent user
- Visual demands

97732-16S.PPT

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Environmental or Occupational Factors

The decision to choose DW or EW.

Environmental factors can be as important as the related physiological factors discussed already.

- **Nature of work.**
  The demand on contact lenses varies greatly from one working environment to another. It is important to evaluate carefully the suitability of DW or EW lenses on a case-by-case basis.
- **Exposure to gas, fumes, chemicals and pollutants.**
  As an example, a microbiologist may benefit more from EW SCL or daily disposable contact lenses for which there is lesser risk of transferring micro-organisms from cultures to contact lenses, solutions and lens cases. An industrial chemist, on the other hand, may be safer with DW RGP lenses which will not absorb chemical fumes in the laboratory. Particulate pollutants in the air can be a source of frequent foreign body irritation to rigid lens wearers (and non-wearers). These employees may benefit from SCLs.
- **Infrequent user.**
  A target shooter, who may need clear and crisp visual acuity only during practice or competitions, may find a daily disposable contact lens more convenient.
- **Visual demands.**
  If the demands on the visual system are high, toric SCLs, toric/bitoric or spherical RGPs may be necessary to provide optimum visual acuity.

14

CONSIDERATIONS FOR DW *vs* EW

INDIVIDUAL CHARACTERISTICS

- Manual dexterity
- Personal preferences
- Previous lens wear experience
- Ocular differences

97732-17S.PPT

4L297732-17

Individual Characteristics

- DW patients handle their contact lenses more than EW patients. In either modality, the amount of mechanical pressure applied to the lenses during handling, as well as the dexterity and level of caution shown by the individual, may determine the risk of lens damage. It is important to assess these factors in prospective contact lens wearers.
- Patients who lack patience and tolerance may find the repetitive processes associated with adaptation to RGP lenses too tedious. In such cases disposable SCLs may be more convenient.
- It is important to be aware of any previous lens wear experience when determining the suitability of a DW or EW schedule. Any unsatisfactory lens wear should be evaluated and factored into the selection of the most suitable lens type and wear schedule.
- Even though most people show only negligible difference between the eyes, it is important to consider each eye independently and to select the lens type and wear modality best suited to the patient. A mix of wear modes is not usually suggested for an individual wearer.

III Selecting a Lens Type

15

INTENDED USAGE
FREQUENCY OF WEAR

- Full-time (6-7 days per week)
- Part-time (2-3 days per week)
- Social occasions only
- Sports
- Work hours only
- Home use only

97732-18S.PPT

4L297732-18

Intended Lens Usage

In consultation with the patient, the intended usage of the contact lenses needs to be ascertained. Many possibilities exist and most have a bearing on the:

- Type of lens selected.
- Maximum wearing time advisable (as opposed to that desired by the patient).
- Replacement rate.
- Level of lens care required.
- Level of professional care required.
- Overall cost of lens wear to the patient.

Intermittent, part-time or casual wear requires special attention to the lens replacement rate and lens storage requirements.

16

REFRACTION ISSUES

- Myopia
- Hyperopia
- Astigmatism (type?)
- Aphakia
- Anisometropia/antimetropia
- Keratoconus

97732-19S.PPT

4L297732-19

Refraction Issues

The ametropia to be corrected influences the choice of lens type since not all Rxs are available in, nor are all suited to, all materials, all replacement schemes or all modes of wear, e.g. aphakic lenses are not available in any 2-week disposable programme, probably should not be fabricated from a low water material (Dk/*t* too low) and arguably should not be worn on an all-day basis (La Hood, 1991) and certainly not on an extended wear basis.

In the interests of enabling manufacturers to stock and offer a finite number of individual products, lens designers and clinical researchers offer a relatively small number of clinical ‘fits’ in a rational range of BVPs. The latter commonly covers the range +6.00D to –10.00D, frequently only offering ±0.50D steps in the higher powers.

Similarly, the extent to which astigmats are catered for with stock lenses is limited in that only a few manufacturers have disposable or planned replacement programmes, and those that do have limited fitting and Rx options. Once the number of different products that need to be manufactured and stocked is estimated (thousands), the magnitude of the manufacturers’ problems with stock torics can be appreciated. While it is feasible to stock spherical RGP lenses, the problem with toric RGPs is almost insurmountable because of the large number of base curves required to satisfy a practical proportion of the potential market. Which is much smaller than the SCL market.

Lenses which lie outside the ‘normal’ clinical range of power are usually supplied as ‘conventional’ lenses, are discarded annually if soft and less frequently if rigid, and require the full range of lens care treatments, i.e. cleaner, rinsing solution, disinfectant and protein remover regularly.

17

CORNEAL TYPOGRAPHY

- Curvature
  - steep
  - flat
  - eccentricity
- Astigmatism
  - WTR
  - ATR
  - oblique
  - irregular
- Keratoconic

97732-20S.PPT

4L297732-20

Corneal Topography

Like the limited range of BVPs available in stock lenses, the range of fits is also limited to allow for a rational stock situation. This translates to two or three base curves in one, and sometimes two, lens diameters.

This restricted number of 'fits' means that corneas with abnormally flat or steep curvatures cannot be fitted satisfactorily, let alone optimally, with stock lenses. This also rules out disposable and/or planned replacement programmes for less common curvatures, since such schemes represent the ultimate form of 'stocked' lenses catering for the middle of the normal distribution curve. While the eccentricity of the cornea is less relevant to SCLs it is an additional factor to be accounted for when considering the possibility of stocking spherical RGP lenses.

The presence and type of astigmatism affects lens choice and availability of stock lenses. If the level of corneal astigmatism is low to moderate and it accounts for all or most of the manifest ocular astigmatism, it follows that the ability of a spherical RGP lens/tear fluid combination to neutralize most (90%) of the corneal astigmatism, may provide the answer. This is also true for cases of corneal irregularity.

When choosing between rigid and soft lenses the orientation of astigmatism warrants consideration. WTR astigmatism, especially with little or no spherical component, often proves to be unsuitable for toric soft lenses due to orientational instability. Conversely, ATR cases may be more suited to soft lenses than RGP lenses. These issues are covered in more detail in Module 3, Units 3.4 and 3.6.

Some stock lens manufacturers offer lenses 'around the clock' thereby including the oblique axes, while others ignore oblique axes altogether. Their offerings relate to the frequency of the axes in the wearer population, possibly coloured by their perceptions of the likely limitations of their designs in the axes not offered.

Keratoconus, like other curvatures that fall outside the 'core' of the normal distribution curve, cannot reasonably and rationally be catered for by stock lens companies. It is probable that it never will. All such cases require 'conventional' lenses made on a custom basis.

18

TEAR ISSUES

- Normal
- Dry eye
- Blink abnormalities

97732-21S.PPT

4L297732-21

Tear Issues

The patient's tear film quality requires assessment so that any existing condition which precludes the use of a particular lens material or lens design can be addressed, e.g. somebody with a marginal dry eye should not be fitted with a thin high water lens. A case of true dry eye may be unsuitable for any contact lens, rigid or soft.

Blink abnormalities may preclude the use of rigid lenses because the wearer may blink excessively, or infrequently, in response to the presence of an RGP lens.

19

OCULAR DIMENSIONS

- HVID - small
  - normal
  - large
- Palpebral aperature
- Pupil size

97732-22S.PPT

4L297732-22

20

OCULAR DIMENSIONS
AVERAGE (RANGE)

CORNEA:		
	HVID	12 mm (11 - 12.5)
	r_o	7.8 mm (7 - 9.5)
	e	0.47 (0.4 - 0.6)
PUPIL:	Diameter	7-8 mm
LIDS:	Palpebral Aperture:	9.5 mm (Race-dependent)

97732-44S.PPT

4L297732-44

21

LENS PARAMETERS
TO FIT THE AVERAGE EYE
RGP

BOZR	7.8 mm (r_o ± 0.1)
BOZD	≥8 mm
TD	9.5 mm (HVID - 2.5)
t_c	
Medium Dk	0.12 mm
High Dk	0.15 mm

97732-43S.PPT

4L297732-43

Ocular Dimensions

HVID is an important determinant of a contact lens' total diameter (TD). As with other ocular parameters, dimensions falling outside the 'normal' range are seldom catered for by stock lenses and a conventional custom lens will usually be required.

Palpebral aperture size is of greater importance when RGP lenses are being fitted.

While pupil size is relevant to all lens types, it is probably of greater import when fitting RGP lenses with relatively small TDs. This is due to the limitations placed on the BOZD or FOZD by relating these parameters to the TD as part of the overall lens design. Visual disturbances can be expected when small OZDs are used in wearers with relatively large pupils, especially in low light levels.

Slides 21 and 22 opposite provide data of the 'average' eye and the parameters of initial SCL and RGP trial lenses for such an eye.

In cases of medium to high Rxs, high water lenses should be used to maximize the oxygen transmission. The thicknesses (centre and regional) should preclude the possibility of pervaporation.

In cases of lower Rxs, either very thin low water lenses or medium thickness higher water lenses should provide adequate levels of oxygen with little risk of pervaporation. Materials or lenses claiming to resist dehydration and/or bulk flow of water through themselves may prove helpful.

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LENS PARAMETERS
TO FIT THE AVERAGE EYE
SCL

BOZR	8.5 mm (r_o + 0.7)
BOZD/FOZD	≥8 mm
TD	14 mm (HVID + 2)
t_c	
Low water	0.035 mm
High water	0.06 - 0.10 mm

97732-46S.PPT

4L297732-46

23

MOTIVATION

- Eye health
- Reduced lens care
- Unit cost
- Extended wear
- Laziness

97732-23S.PPT

4L297732-23

Motivation

Motivational issues go beyond merely choosing contact lenses over alternative forms of vision correction.

Patients who are primarily motivated by the ‘desirability’ of a particular type of contact lens are rarely encountered. However, some may express an interest in how a particular type rates ‘physiologically’ relative to the alternatives, or may enter discussions on the subject.

More commonly, prospective patients are motivated by the expectation of lowered requirements for lens handling and lens care, initial cost of the lenses and overall lens ‘ownership’ costs.

As is demonstrated repeatedly in market surveys of contact lens wearers, the concept of extended or continuous wear has great appeal. Desire for extended and/or continuous wear is expressed frequently in consulting rooms.

The suitability of the patient, their Rx, etc. to the eye physiology accommodated by the current generation of contact lens materials and designs needs to be ascertained. Should these desires arise from a wearer’s laziness, a prudent practitioner will try to determine whether any lenses should be fitted at all, or whether the patient might be susceptible to a little ‘re-education’.

24

LENS OPTIONS

- Lens design
- Lens material
- Lens parameters available
- Frequency of replacement
- Mode of wear

97732-24S.PPT

4L297732-24

Lens Options

Lens options available to a particular patient must take the foregoing issues into consideration. Providing the requirements are sufficiently common, most options are available, albeit with some reduction in choice. If a particular mode of wear or a type of planned replacement is contemplated, the choice may narrow somewhat. However, in most cases this is not a major hurdle to selecting a suitable lens because the industry provides efficacious combinations of lens design, material and replacement programmes. While stock lenses may represent something of a compromise, usually they are able to meet most needs.

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LENS TYPES

- Sph SCL
- Sph RGP
- Toric SCL
- Toric RGP
- Tint
- Bifocal
- Special

97732-25S.PPT

4L297732-24

Lens Types

In addition to the common types of lenses available, there are occasional needs for special lenses. These include hybrid lenses (e.g. Softperm™ for keratoconus or some other type of corneal irregularity), special tints for the purpose of aiding defective colour vision (e.g. X-Chrom or similar), theatrical lenses, cosmetic opaques to mask disfigured eyes, etc. Generally, keratoconic lenses fall into one of the more common classifications, e.g. spherical RGP.

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CHOICE OF LENS TYPES

• Low spec cyl	→	sph SCL
• Spec cyl = K cyl	→	sph RGP or toric SCL
• Irregular K	→	sph RGP
• Medium - high Rx	→	sph RGP
• High Rx	→	sph SCL
• Internal cyl	→	toric SCL
• High K cyl	→	bitoric RGP
• High VA/High O_2	→	RGP

97732-26S.PPT

4L297732-26

Choice of Lens Type

Ultimately, the practitioner must settle on a type of lens which best suits the patient's needs after consideration of all relevant aspects.

This table suggests the lens type theoretically most suitable for each refractive circumstance. While these suggestions may not be the lenses chosen finally, for various reasons including patients' responses, it does provide an appropriate starting point to the process of prescribing contact lenses. As with most aspects of contact lens practice, an application of clinical 'art' is often required. The application of clinical 'science' cannot guarantee clinical success while humans are involved in either aspect (i.e. practitioner or patient) of a contact lens consultation.

The recommendations in this list are based largely on optical/physical considerations. Usually, the determination of the apparent oxygen demands of the cornea/anterior eye is determined indirectly using 'secondary' clues such as visible signs of oedema, e.g. striae, folds, limbal vascular engorgement or neovascularization.

27

SOFT LENSES SUGGESTIONS

• High Rx	→	high water
• Dry eye/dryness	→	low water/thick t_c*
• Dryness + high Rx	→	low water/thin t_c
• Incomplete blink	→	low water/mid t_c
• Toric + high Rx	→	high water
• Low Rx	→	low water/thin t_c

*See notes

97732-27S.PPT

4L297732-27

Soft Lens Selection: Water Content & t_c

The choice of lens material and centre thickness is usually based on physiological considerations.

Where Rxs are high, the resultant regional lens thicknesses, and their effects on lens oxygen transmissibility, warrant consideration.

In cases of dry eye or those reporting dryness symptoms without contact lenses, steps are required to prevent the bulk flow of water from the anterior cornea via the lens to the atmosphere (pervaporation). The option of a *thick* t_c should only be exercised if the cornea's physiology will not be compromised excessively. The choice of water content has been addressed previously (Section II). Pervaporation is less of a problem in thicker designs, e.g. most torics. Considering the reduced likelihood of pervaporation and the need for improved transmissibility with such lenses, the material of choice is high water.

Regular replacement of lenses has also been shown to be beneficial in limiting dry eye symptoms (Guillon, 1997).

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SOFT LENSES: IONICITY

- High Rx → non-ionic
- Dry eye, dryness → non-ionic
- Allergy → non-ionic
- Incomplete blink → non-ionic
- Toric + high Rx → ionic or non
- Low Rx → ionic or non

97732-28S.PPT

4L297732-28

Soft Lenses: Ionicity

This question is not straightforward because our current knowledge of the issues involved is incomplete. While it is agreed that ionic materials attract more deposits (Minno *et al.,* 1991 and Myers *et al.,* 1991), a material's water content is also a factor. Further, ionicity also influences the type of deposit attracted to the lens surface (ionic materials attract hydrophilic lysozyme whereas non-ionic materials attract hydrophobic albumin and lactoferrin (Tighe in Guillon *et al.,* 1997)). These in turn affect lens wettability. This area has been investigated in the context of daily disposable soft lenses and no clinical differences were found between high water ionic and non-ionic materials (Guillon *et al.,* 1997).

29

RGP LENS SUGGESTIONS

- High Rx → high DK
- High K cyl → high Dk/med t_c
- Low Rx → med-high Dk
- GPC → med-high Dk
- Dry eye/dryness → med DK
- Dry eye + high Rx → high Dk
- Low WTR cyl → high Dk/average t_c

97732-29S.PPT

4L297732-29

RGP Lens selection

The factors influencing the choice of lens material and lens thickness are essentially similar to those affecting soft lens selection. One difference is the need to consider lens flexure *in situ* and its effect on the correction of corneal astigmatism. Thin flexible RGP lenses will result in lens flexure on toric corneas. An incomplete, or even variable, correction results.

To address this problem, either a more rigid lens material is required, or the lens thickness needs to be increased. Both factors can be altered, but any changes should not be detrimental to the final Dk/*t*.

30

SOFT LENSES: WEARING TIME

- Daily wear
  - low water
  - thin t_c
- Extended wear
  - high water/thick
  - low water/thin

97732-30S.PPT

4L297732-30

Soft Lenses: Wearing Time

In the interest of minimum acceptable lens transmissibility, daily wear lenses should be thin (range: 0.035 – 0.06 mm) if low water materials are used (37 - 40%). The use of higher water materials will usually increase the transmissibility and are as suitable, or more suitable, for daily wear. To prevent pervaporation problems, thin high water materials of current technology should not be used. Future high Dk materials will probably be of relatively low water content, resulting in the pervaporation issue being rendered irrelevant.

31

WEARING TIME: DW or EW ?

Wear: DW, Fit: EW

- High Rx, fit: EW, wear: DW
- Seek signs of adverse responses

Wear: EW, Fit: EW

- Necessary
- One night only (FW)
- Must have no adverse signs

97732-31S.PPT

4L297732-31

Wearing Time: DW or EW?

The issues of DW *versus* EW have been already been covered in this Unit (Section II).

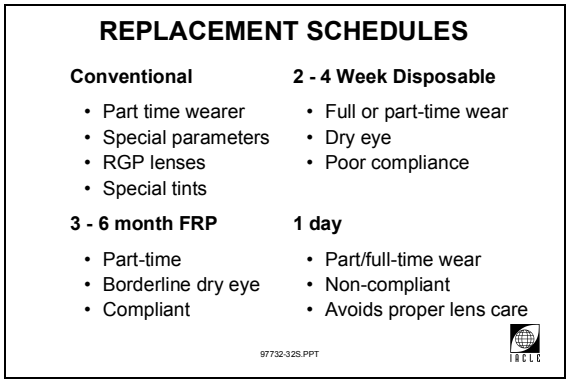
Even if DW is contemplated, the physiological conditions under the lens need consideration. If the Rx is high (lower transmissibility), lenses offering better physiology are required. Lenses nominally intended for use in EW are suitable candidates. When lenses of lower transmissibility are used, the practitioner should be alert to the increased possibility of an adverse corneal response to the resultant hypoxia.

The high physiological demands of the anterior eye under closed-eye conditions can only be met by

lenses intended for the purpose. The increased risk of ulcerative keratitis (9X) from using DW lenses in EW has already been demonstrated (Schein *et al.,* 1989). Practitioners should counsel patients on the relative merits and risks of DW *versus* EW.

The adage 'If in doubt, take them out' should be reinforced at every opportunity.

32



4L297732-32

Replacement Schedules

Common schedules of replacement vary somewhat from country to country, even for identical products. These differences reflect the differences in local perception of the potential problems, cultural issues, economic issues and, sometimes, the level of education and knowledge of the local practitioner population. With the 'globalization' of information and the dominance of the contact lens industry by the large multi-national companies, regional differences can be expected to decrease over time.

This slide shows the most common general schemes in operation world-wide. Many practitioners will customize schemes to suit their practice style or individual patient needs. The suitability of the various schemes to particular wearing pattern, compliance levels and ocular conditions is presented.

A study to address the pertinent question 'How often should lenses be replaced?' using comfort, vision and lens wettability criteria provided the answer 'one week to three months,' subject to individual variation (Guillon *et al.,* 1992). While this is suggestive of the need for a range of replacement rates, the difficulty of assessing the patient to decide which one is appropriate and the administrative overheads likely to follow such a decision is difficult to justify. Most choose to adhere to one of the common schemes.

It has been claimed that wearers find the 'Rule of Ones' easier to follow, i.e. one day, one month or one year. The popularity, and apparent success, of 2-week replacement schemes raises questions about the 'Rule of Ones'.

Conventional lenses are seen by some as meaning 1-2 years of often 6-7 days a week wear. This is imprudent and as a maximum, 'conventional' should be synonymous with *annual* replacement. Gellatly *et al.* (1988) showed that for daily wear HEMA lenses (low water, non-ionic), reduced vision and deposits resulted in an unsatisfactory clinical situation after 12 months or 4,000 hr of wear. High water and ionic high water lenses can be expected to deliver shorter or much shorter total wearing times.

IV Choosing a Lens Wear Modality

33

CHOOSING A WEAR MODALITY
PATIENT REQUIREMENTS

- Convenience
- Safety
- Comfort
- Knowledge/education

97732-33S.PPT

4L297732-33

Patient Requirements

When choosing a wear modality, a key issue in the minds of new contact lens wearers is convenience. Overnight wear of lenses provides the greatest convenience but also carries the greatest risk. The latter factor is usually not apparent to the novice contact lens wearer.

When establishing a wearing schedule, the practitioner must weigh the desires of the patient against the need to consider the long-term ramifications of contact lens utilization. Safety and comfort are probably the most important considerations in determining the optimum lens wear modality.

It is important that the reasons for selecting a particular wearing schedule are clearly explained to the patient. This should be regarded as part of their contact lens education.

34

CHOOSING A WEAR MODALITY
LENS SELECTION

- Material characteristics
- Fitting characteristics
- Parameter range

97732-34S.PPT

4L297732-34

Lens Selection

The optimum wearing schedule for each patient is dictated by many different factors. Even though a wide range of lenses is available to the practitioner, it is possible that an optimal fitting is not achieved. In such cases the lens wearing schedule should be based on the quality of the fitting that is achieved.

35

CHOOSING A WEAR MODALITY
PURPOSE, DEMANDS AND NEEDS

Increased requirement for lens wearing time = increased requirement for higher Dk/*t*

97732-35S.PPT

4L297732-35

Purpose, Demands and Needs

The individual visual needs of patients vary. Occupational and recreational activities also have varying visual demands. The total wearing time is not as important a consideration as the duration of each wear period, and the environment the patient and lenses are exposed to during use. The longer the wearing time needed, the higher the oxygen transmissibility required, especially if EW (or FW) is contemplated.

NOTE: See Units 9.2 and 9.3 for discussions on contact lenses in the working environment and for sporting activities.

V Choosing a Lens Replacement Schedule

36

LENS REPLACEMENT SCHEDULE
FACTORS

- Cost
- Convenience and practicality
- Patient management/counseling
- Therapeutic purposes
- Maintaining inventory

97732-36S.PPT

4L297732-36

Lens Replacement Schedule

The lens replacement schedule is dictated by a number of factors which must be considered on a case by case basis. Considerations include the requirements for work and recreation, convenience, the likely compliance level and even local availability of such schemes. The advantages and disadvantages of the various lens replacement schedules will be discussed under the headings listed in slide 35.

37

LENS REPLACEMENT SCHEDULE
COST

- RGP lens are more cost-effective
- Lens costs *vs* lens care costs

97732-37S.PPT

4L297732-37

Lens Replacement Schedule
Cost

Of major concern to patients is the cost of lenses and their maintenance. RGP lenses have the longest life span and can usually be polished to remove scratches, deposits and surface films They can be modified for small power or parameter changes, which eliminates the need to order new lenses whenever a change becomes necessary. These features make them the most cost-effective lens type.

Current market trends and significantly improved manufacturing technology have made daily disposal and frequent replacement of lenses affordable. Because solutions are not required with daily disposable lenses, the higher cost of such lenses can be partially offset by the savings on the lens care products required with other replacement schedules.

Warranties, life expectancies and replacement costs for different lens types may differ and should be explained clearly to the patient.

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LENS REPLACEMENT SCHEDULE
CONVENIENCE AND PRACTICALITY

- Frequent lens handling
- Propensity to lose lenses
- Frequent travellers

97732-38S.PPT

4L297732-38

Lens Replacement Schedule
Convenience and Practicality

The convenience aspect should embrace broadly all aspects of contact lens wear from the care regimen to the ease and practicality of lens replacement. Frequent lens handling associated with DW may be a source of contamination and lens damage for geriatric and paedriatric patients or people engaged in manual labour. In such cases, DW conventional lenses are not as convenient or practical as EW or, possibly, daily disposable lenses.

Some patients may exhibit a propensity to lose their lenses more frequently than others. Because disposable lenses dispensed in multiple packs, they will have spare lenses are on hand. This reduces the inconvenience associated with not being able to obtain a replacement lens quickly.

People who are frequent travelers, or who wear their lenses occasionally, have special needs. Storage of lenses for longer than normal periods is an issue all too often ignored but which is fraught with potential dangers. These dangers are greater if the care products have relatively low antimicrobial powers.

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LENS REPLACEMENT SCHEDULE
PATIENT MANAGEMENT

Frequent replacement:

- Produces fewer complications
- Reduces chair time
- Prevents deposit build up

97732-39S.PPT

4L297732-39

40

LENS REPLACEMENT SCHEDULE
PATIENT COUNSELING

- Maintaining wear schedule
- Compliance:
  - solutions
  - lenses

97732-40S.PPT

4L297732-40

Lens Replacement Schedule

Patient Management/Counseling

Overall ocular health is usually better with frequent replacement and disposable contact lenses because, physiologically, corneal homeostasis is better maintained with such lenses. RGP lenses offer the same advantage possibly because of their higher oxygen transmissibility. However, as discussed previously, the incidence of infectious keratitis and sterile infiltrative keratitis seem not to be reduced significantly by the use of disposable lenses.

As well as the ocular health aspects, reducing the onset of complications means reduced chairtime. Frequent replacement and disposable lenses prevent deposit build-up, so that deposit-related complications can be prevented. RGP lenses may develop scratches, and often a protein film forms on the lens surface using scratches to establish a foothold on the lens. However, surface scratches and deposit can be readily polished off prior to any significant build-up forming on the surface.

Wearer success is frequently dependent on the quality of the counseling provided at the commencement of lens use. A clear understanding of the reasons for selecting the lens replacement schedule and the need for wearer compliance are fundamental to achieving optimal wear.

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LENS REPLACEMENT SCHEDULE
THERAPEUTIC PURPOSES

- Use thin, EW, high water content lenses
- If Rx irrelevant, select lens with lowest *average* thickness

97732-41S.PPT

4L297732-41

Lens Replacement Schedule

Therapeutic Purposes

Some lenses have properties that permit their use as a therapeutic device. Such lenses aid the healing process by preventing mechanical exfoliation of the growing epithelial cells during a blink. They also allow instillation of medication with the lens *in situ*. Therapeutic lenses are usually plano powered thin, EW, high-water content lenses, and are available as conventional, frequent replacement and two-weekly disposable lenses. If therapeutic lenses are not available and the Rx is irrelevant, the lens with the lowest average thickness should be chosen from a lens series of known high physiological performance. The thinnest lens is often around –1.00 D sphere.

Conventional lenses used for therapeutic purposes should be discarded after use.

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LENS REPLACEMENT SCHEDULE
MAINTAINING INVENTORY

Frequent replacement
↓
Large lens-inventory
↓
Requires efficient control system

97732-42S.PPT

4L297732-42

Choosing the Lens Replacement Schedule

Maintaining Inventory

Frequent lens replacement necessitates a large lens inventory in a practice. Such inventories represent a significant investment by the practice. Lens inventory levels should be maintained to allow immediate dispensing of lenses to the majority of patients.

Where possible, a planned replacement program should be made available to each patient where it might encourage compliance. Since patients like maximum convenience, lens dispensing and collection should ideally be scheduled during the after-care visits.

This will allow staff members to check the lens inventory prior to the after-care visit and order lenses if necessary.

Fitting frequent replacement or disposable lenses in a practice necessitates a large inventory which requires some form of stock control. Today, computerized stock and inventory control software is available to manage these issues and out-of-stock situations should be uncommon.

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Unit 4.3

(1 Hour)

Lens Dispensing and Patient Education

Course Overview

Lecture 4.3: Lens Dispensing and Patient Education

I. Contact Lens Dispensing Routine

II. The Dispensing Visit

Practical 4.3: Insertion and Removal of Contact Lenses

Lecture 4.3

(1 Hour)

Lens Dispensing and Patient Education

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I Contact Lens Dispensing Routine **61**

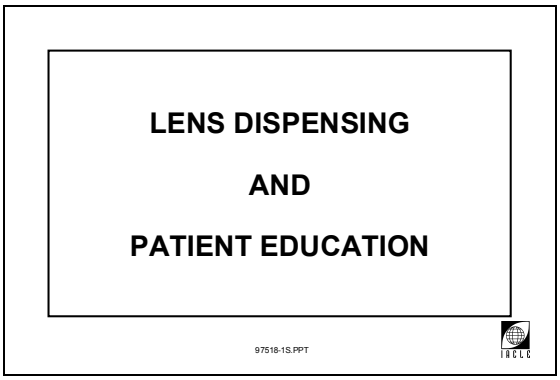
II The Dispensing Visit **65**

II.A Vision and Fitting Assessment 65
II.B Patient Education and Instruction 66

II.C Adaptive Symptoms 74

I Contact Lens Dispensing Routine

1



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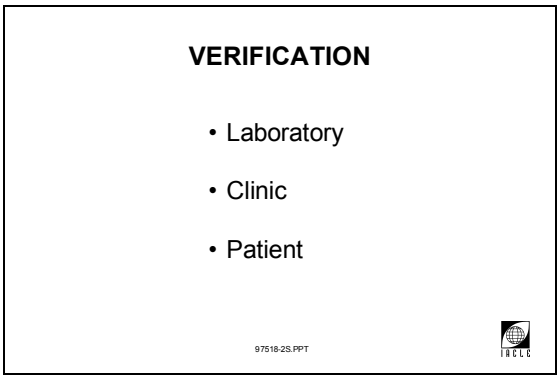
Lens Dispensing and Patient Education

The contact lens dispensing routine includes:

- Verification of the contact lens parameters before the dispensing visit.
- Proper storage and labeling.
- 'On-eye' vision and fitting assessment.
- Practice of lens insertion and removal.
- Instruction on lens care and maintenance.
- Instruction on adaptive symptoms
- Instruction on trouble-shooting.
- Scheduling after-care visits.

2



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Verification

Verification of contact lenses involves three stages:

- Laboratory.

  Laboratory verification is usually performed in conjunction with each phase of the manufacturing process. Verification of each parameter generated during manufacture is required. Automated manufacturing processes require fewer verification steps. During the final phase of manufacture, an overall parameter check is performed to ensure the lenses do not differ significantly from the parameters ordered by the practitioner.

- Clinic.

  It is the responsibility of the practitioner to verify that the contact lenses received have the correct parameters. Warranties for a limited time period are offered by most laboratories. Verification of lenses upon receipt, rather than during the dispensing visit, is advisable. This enables warranty claims to be made and assures the practitioner that the lenses are within tolerance.

- Patient.

  Assuming the original practitioner's order was appropriate for the patient, 'on-eye' fit is another indicator of whether a contact lens has been manufactured to specifications. A satisfactory lens-to-cornea relationship with adequate tear exchange should be the main objectives of the fitting assessment.

3

HYDRATED SCL TOLERANCES

Room temperature: 20 ± 0.5°C
Hydrating solution: 0.9% saline

BCOR:	±0.20 mm
BOZR:	±0.20 mm (wet cell)
	±0.10 mm (dehydrated)
BPOR:	±0.20 mm
BVP:	±0.25 D (+10.00 to -10.00 D)
FCOD:	±0.20 mm
TD:	±0.20 mm
t_c and t_{EA}:	±0.03 mm

97518-3S.PPT

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4

HARD CORNEAL LENS TOLERANCES

BCOD:	±0.05 mm (light blend)
	±0.10 mm (medium & heavy blend)
BOZR:	±0.02 mm
BPCD:	±0.05 mm
BPR:	±0.10 mm
BVP:	±0.12 D (+10.00 to -10.00 D)
	±0.25 D (>10.00 D)
FCOD:	±0.10 mm
TD:	±0.05 mm
t_c and t_{EA}:	±0.02 mm

97518-4S.PPT

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Parameters to be Checked In-House:

In-practice parameter verification should be performed to confirm that:

- Parameters fall within acceptable tolerance limits (Pearson, 1979; Standards Association of Australia, now Standards Australia, 1976). Slides 3 and 4 show the tolerances for soft and rigid contact lenses according to Australian Standard 1887 - 1976, the first comprehensive standard published in the world.
- There are no manufacturing defects.
- The correct tint, if any, is incorporated.

Key to the accompanying slides:

BCOD	Back Central Optic Diameter
BOZR	Back Optic Zone Radius
BPOR	Back Peripheral Optic Radius
BVP	Back Vertex Power
BPCD	Back Peripheral Curve Diameter
BPR	Back Peripheral Radius
FCOD	Front Central Optic Diameter
TD	Total Diameter
t_C	Centre Thickness
t_{EA}	Axial Edge Thickness

5

STORAGE AND LABELLING

- Use proper lens cases
- Label cases and boxes prior to dispensing
- Use proper storage or disinfecting solution to ensure hydration

97518-5S.PPT

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6

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Proper Storage and Labeling

Lenses that arrive from laboratories are often stored in vials or cases which are inappropriate for patient use. Contact lens cases should have the following characteristics:

- Deep wells that fully submerge the contact lenses in the storage solution.
- Wells with a concave floor and ribbed walls to prevent lenses adherence and allow easy lens removal.
- Lens baskets of a size and design to preclude puncturing the lens with the clasp when closing the basket.
- Made of plastic materials that are heat resistant to allow disinfection of the case by immersion in boiling water.
- Clear markings of 'R' and 'L' with the letters (or some other means of identification such as dots) raised for tactile identification.

Slide 6 shows an assortment of cases for rigid and soft lenses most of which meet the requirements presented above.

7

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Disposable contact lenses are usually supplied in boxes containing several individually blister-packed contact lenses (slide 7).

Because blister packs cannot be resealed, disposable lenses are not verified routinely prior to dispensing. Manufacturers are aware of this and due consideration is given to this added responsibility in their manufacturing quality assurance programmes.

Preparation of RGP lenses for dispensing should include a thorough cleaning and rinsing followed by disinfection/conditioning in an appropriate disinfecting/storage solution, preferably overnight.

Hydrating lenses prior to dispensing eliminates the fitting problems caused by parametric variations and enhances their surface wettability.

8

EFFECTS OF HYDRATION

- RGP hydration flattens BOZR
- Dehydration-hydration changes are smaller for low water SCLs
- Linear relationship between refractive index and water content

97518-6S.PPT

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Effects of Hydration

Hydration or the degree of hydrophilicity (wetness) depends on the amount and method of binding of water to the lens polymer. Alterations in hydration can result in parametric variations in contact lenses. These variations have implications for verification and fitting:

- Sakata and Koide (1992) studied the effect of hydration on the BOZR of RGP contact lenses. Their study shows minus lenses flatten with hydration. Higher power and thinner centre minus lenses have greater degrees of flattening.
- In order to negate the effect of hydration changes on the BOZR, Barr and Hettler (1984) recommend that RGP lenses (Boston II was used in the study) be soaked for at least four hours prior to assessing the BOZR fit on the patient. It takes about one hour for a hydrated lens to revert to its dehydrated state.
- The degree of dehydration-hydration change is less for lower water content SCLs (Dormon-Brailsford, 1974). This results in better stability than high water content lenses.

Other factors relating to hydration of SCLs are worthy of mention because of their influences on fitting:

- The individual variation in tear pH, and the faster dilution by tears of care solutions which are more alkaline, have induced manufacturers to formulate solutions with a pH of 8 - 9. This suggests that a soaking solution that more closely matches the pH of tears should be used for trial lenses.
- Most solutions have osmolalities that are the same as tears or close to normal saline (0.9%). This is necessary to avoid fitting alterations induced by osmotic forces caused by differences between storage solution and tear tonicities. When using trial lenses, misleading

fits can be avoided by soaking the lenses in solutions which have the same tonicity as tears and allowing a period of adaptation (around 15 min) prior to assessment.

The linear relationship between refractive index and water content (Mousa *et al*., 1983; Fatt and Chaston, 1980), although small, makes high water content SCLs more prone to BVP changes (<0.25 D) during increases in temperature of 14°C. The changes in lens optics have been found to be closely related to the front and back surface curvature rather than to centre thickness or refractive index.

II The Dispensing Visit

II.A Vision and Fitting Assessment

9

RESPONSIBLITIES OF THE PRACTITIONER

At the dispensing visit:

- Contact lenses
- Good vision
- Contact lens fitting
- Care and maintenance instruction

97518-7S.PPT

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Responsibilities of the Practitioner

- Ensuring that contact lenses dispensed have the correct parameters, are sterile and in good condition.
- Ensuring that optimum visual acuity is achieved by the patient with the contact lenses.
- Ensuring that the contact lenses fit satisfactorily.
- Providing instruction on care and maintenance.
- Personally supervising the practice of relevant procedures until the patient becomes confident and adept at lens insertion, removal and handling.
- Ensuring that the patient understands the responsibilities involved in contact lens wear and the importance of after-care visits.
- Describing the anticipated adaptive symptoms.
- Providing the patient with information on insurance, and warranties relevant to their contact lenses.

10

VISION ASSESSMENT

During the dispensing visit:

- Assess visual acuity before and after over-refraction

97518-8S.PPT

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Vision Assessment

- At the time of the dispensing visit, the ideal corrected visual acuity (VA) should equal or better the expected VA based on that obtained during the trial fitting visit.
- The unaided VA should be measured prior to insertion of the contact lenses to be dispensed.
- VA with contact lenses is taken after the Best Sphere (BS) and sphero-cylindrical over-refractions. Vision can be checked using high and low contrast visual acuity charts. Distance and near visual acuity should be tested.
- If minor deficiencies in VA and Rx are found, do not change the lens(s) at this stage but check again at the first after-care visit.

11

FITTING ASSESSMENT

- Static and dynamic fitting
- Surface wettability and lens quality
- Corneal integrity

97518-9S.PPT

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Fitting Assessment

- Both static and dynamic fitting of the contact lens should be checked. These should be checked with the slit-lamp using both white and cobalt blue light (for RGP contact lenses).
- Lens surface wettability and overall lens quality should be observed with a slit-lamp while the lenses are *in situ*.
- Check to ensure that no corneal insult is evident after fluorescein instillation following removal of the contact lenses.

II.B Patient Education and Instruction

12

Patient education and

instruction is a continuous

process

97518-18S.PPT

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13

FACTORS TO CONSIDER IN PATIENT INSTRUCTION

- Care regimen suitable for the patient
- Age and gender
- Intelligence of the patient
- Type of contact lenses dispensed
- Occupational and visual demands
- Environmental exposure
- Temporary conditions

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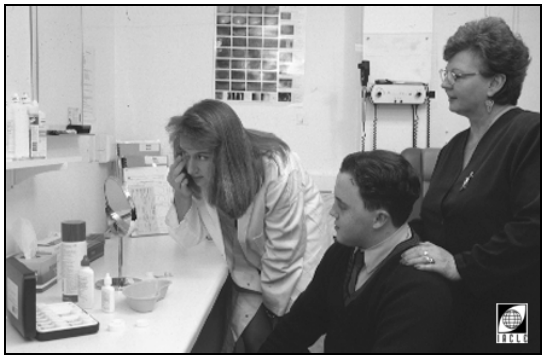
14



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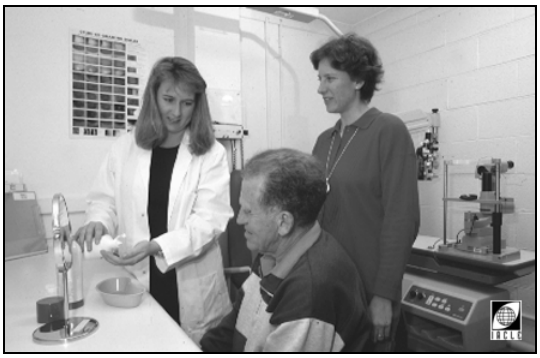

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Factors to Consider in Patient Instruction

Patient education and instruction is critically important in ensuring compliance with recommended care and maintenance procedures. It is important to note that patient instruction does not end with the completion of the dispensing visit. It is a continuous process that forms a part of each after-care visit.

It involves a variety of approaches depending on a number of factors:

- Care regimen suitable for the patient, especially if there is a known sensitivity.

  Contact lens solutions are available in a variety of formulations and have different applications for different contact lenses. There have been numerous reports of patients suffering from hypersensitivities and allergies to preservatives. Obviously, solutions which do not contain the chemical(s) known to offend a particular patient should be selected, where this is possible.

- Age and gender.

  Different instructional approaches are required for children and adults For children, simple vocabulary and demonstrations to aid understanding should be used. The element of play can be included without loss of emphasis on the importance of care in contact lens wear (slide 14). Aged patients may require special aids such as a magnifying glass. Alternatively, family members can be taught to take care of the lenses as well as lens insertion and removal (slide 15).

  Gender difference usually becomes an important factor when considering the use of cosmetics and creams. Appropriate make-up types and their application should be stressed. Hair sprays have also been known to contaminate or even ‘etch’ contact lens surfaces.

- Intelligence of the patient.

  For some patients verbal instruction is adequate while others require handouts (preferably with illustrations) detailing the steps and providing tips on lens care and handling. It is always best to provide adequate written guidelines for the patient. It is also common for patients to require additional visits to master lens insertion and removal.

- Types of contact lenses dispensed.

  RGP, disposable and conventional SCLs all differ in their care regimen. The adaptation period for RGP lenses requires a slower build-up of wearing time for new wearers or those

who have discontinued lens wear for a long time. Disposable SCLs eliminate the need for protein cleaning. Conventional SCLs for daily and extended wear require greater compliance.

- Occupational and visual demands.

  Frequency of wear should be determined so that appropriate instructions on the care, maintenance and storage of unworn lenses can be provided. Units 9.2 and 9.3 provide in depth discussions of contact lenses in relation to sports and the working environment.

- Environmental exposure.

  Risks of exposure to the environment should be stressed, especially if the patient is regularly exposed to less than ideal conditions. Frequent exposure to chemical vapors and gases can cause discomfort and may limit the wear of SCLs due to absorption. A surfer needs to be instructed on the use of contact lenses at the beach and the cleaning necessary after swimming.

- Temporary conditions.

  Other conditions may require modification to, or limits on, wearing time for the duration of the condition. For example, a patient undergoing medical treatment with eyedrops or ointments that can contaminate lenses should discontinue lens wear during treatment. Instruction on modifying wear modality and cleaning should be provided.

16

The clinical assistant provides

support services and is a

valuable resource in the practice

97518-11S.PPT

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Educating/Training the Clinical Assistant

Because all of the factors above require some level of familiarity with the patient, the practitioner is the best person to provide instruction to the patient. However, in a busy practice, practitioner time can be optimized by utilizing the skills of a suitably trained clinical assistant and delegating some of the clinical tasks to them, e.g. history taking, keratometry, auto-refractometry, visual fields and teaching contact lens care and maintenance (slide 17).

17

CLINICAL ASSISTANTS

Delegate:

- History taking
- Keratometry
- Autorefactometry
- Visual fields
- Teaching of CL insertion and removal

97518-26S.PPT

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Education and training of the assistant by the practitioner is a necessary prerequisite for such delegation (slide 19). During such education and training, they learn specific skills and develop a better understanding of, and an appreciation for, what the patient experiences during an eye examination. In the case of contact lens instruction, the assistant will acquire an understanding of the process from the patient's viewpoint.

18

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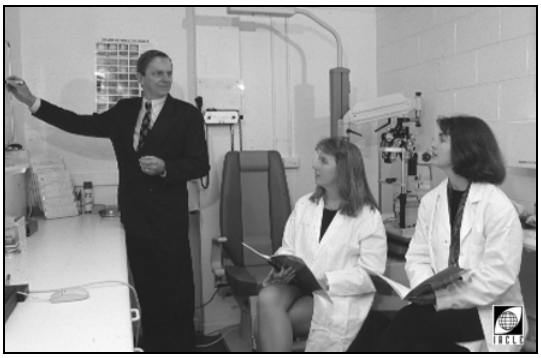
19



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Resources for education and training of the clinical assistant include (slide 20):

- Videotapes that provide systematic and consistent instruction.
- Written materials from journals and textbooks. The following are helpful references:
  - Home Study Course for Optometric Assisting (American Optometric Association - Paraoptometric Section, 1989)
  - Seven Steps to Better Patient Care: An Educational Resource for the Contact Lens Assistant (Contact Lens Spectrum, November 1994).
- Industry representatives who have product-specific knowledge.
- Seminars, workshops and conferences.
- Case study sessions led by the practitioner.

21

TEACHING LENS HANDLING TECHNIQUES

- Insertion and removal
- Storage and removal from the case
- Rub and rinse process
- Accidental lens ejection and displacement
- Emergency lens removal

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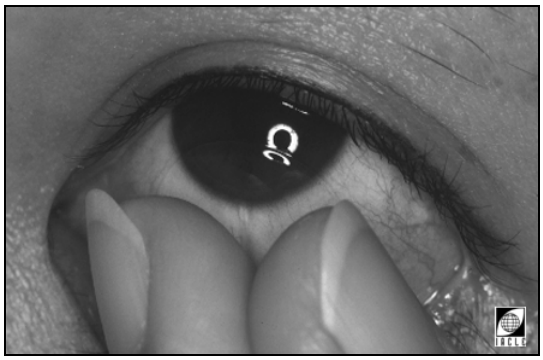

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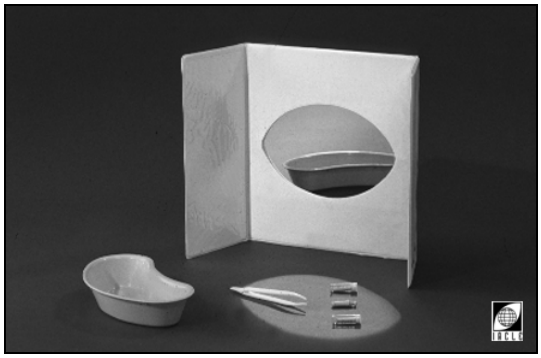

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24

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Teaching the Patient Lens Handling Techniques

Proper lens handling by the patient should be taught. It involves:

- Insertion, removal and recentring of lenses (see Practical 4.3).

  Teaching lens insertion and removal is greatly assisted by showing the patient a videotape demonstration of the techniques. This should then be followed by a step-by-step, supervised, hands-on session with the patient.

- Storage and removal from the case.

  A commonly encountered situation in a contact lens practice is a patient who has torn or damaged a contact lens while closing the lid or removing it from the case. Demonstrating the placement of a contact lens in a case prior to pouring the disinfecting or storage solution (to ensure full immersion) will help prevent the lens getting caught in the lid of the lens case.

  Removal from the case is another problem which causes lens damage. Stressing the importance of short fingernails and careful lens extraction techniques will help prevent this type of lens damage (slide 22).

- Rub and rinse process when cleaning (slide 23).

  The importance of washing the hands prior to lens handling should be stressed. The contaminating effects of inks, cosmetics and dirt should be explained. Providing a list of contaminants can be a useful precaution. The patient should be made aware of the dangers of long fingernails, leaving rings on fingers while cleaning, and aggressive handling of the lenses.

- Accidental ejection from the eye.

  Procedures to be followed when lenses are accidentally ejected from the eye should be discussed. Patients should be advised to carry a lens case filled with fresh storage solution. Emergency procedures and substitute solutions (e.g. comfort drops approved for use with the type of contact lenses involved, soft lens storage solutions even if the lenses are RGPs but not the reverse and, as a last resort, drinkable water provided a thorough and complete lens care cycle follows as soon as possible) should also be discussed. In the absence of a lens case, a drinking glass, tablet bottle or other suitable small container may have to be employed.

  The risk of the contents (and by implication the lens) being discarded by other people needs to be addressed.

  Contact lenses dislodged from the cornea can

cause patient distress, especially if they are RGPs. SCLs can become folded while *in situ.* Patients should be taught how to locate the dislodged lens in the eye and how to recentre it. Practicing the techniques avoids panic and dispels any fallacies of the lens getting lost at the 'back of the eye' (see Practical 4.3).

- Emergency lens removal.

  Situations may arise where the contact lens has to be removed, due to embedded foreign bodies, onset of infection, etc. Often, a 'scleral wash or massage' may be all that is needed by the patient when discomfort is felt. The handling of contact lenses during an adverse response, when discomfort persists or in emergency situations should be discussed. Contact phone numbers of the practitioner should also be given to the patient in case of an emergency.

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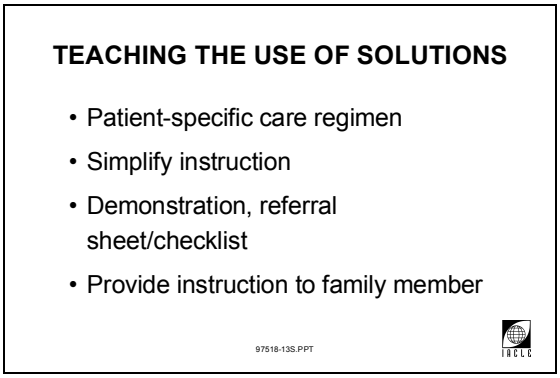

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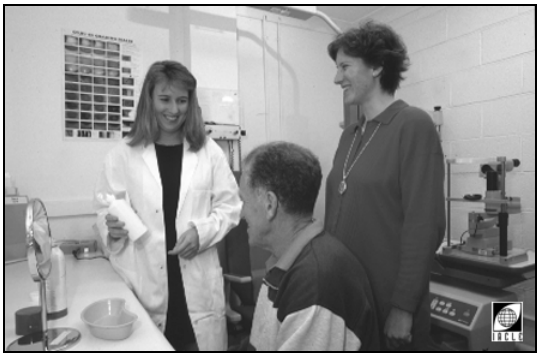

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Teaching the Use of Solutions

- In giving instruction on the use of solutions, it is important to stress to the patient that a specific care regimen has been recommended (and provided) to them. This means that they are to be discouraged from purchasing substitute solutions without discussing the matter with the practitioner. The following should be explained to the patient:
  - There are a large variety of solutions available in the market and differences in formulations prohibit the mixing and matching of non-recommended preparations.
  - People exhibit different individual sensitivities to preservatives in solutions.
  - The care regimen has been specifically recommended based on the patient's specific lens type, wear modality, needs and wearing schedule.
- Young and elderly patients should be given the simplest care regimen possible. Explanations should be simple and avoid the use of technical terminology as this will sound overwhelming and may be too complicated for the patient
- The use of each solution is best explained by demonstration during the instruction session. Showing the patient the accompanying product literature also helps ease any concern about forgetting how to use them. Alternatively, providing the patient with a referral sheet/checklist with more simplified instructions is often helpful.
- For young and elderly patients, the same instructions for solution usage should be given to a member of the family who will supervise or perform the care and maintenance procedures.

27

TEACHING CARE OF THE LENS CASE

- Provide samples of different lens cases
- Lens replacement schedule and cleaning instructions
- Note visual clues as to the standard of care
- Illustrate graphically risks of non-compliance

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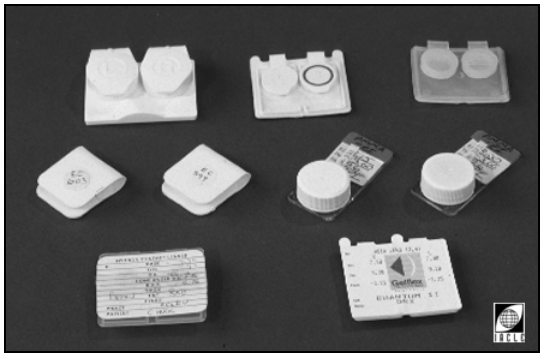
28



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Teaching Care of the Lens Case

Instruction on care of the lens case is often the most neglected or inadequately emphasized part of patient education:

- Some wearers have been known to use the wrong type, e.g. using a vented case as a travelling case.
- Lens case replacement schedule and cleaning/sterilizing instructions should be written down as patients tend to observe these requirements irregularly.
- Neglect of care for the lens case is common, especially amongst experienced contact lens wearers who have not encountered any problems. Characteristically, these patients will have old, scratched, cracked, dirty and mouldy lens cases. These visual clues are strong indications of a need for patient re-education.
- Showing photos of dirty cases and the associated complications can imprint on the mind of the patient the risks of non-compliance. However, excessive use of such materials can amount to negative ‘marketing’ of lenses and lens wear, and may adversely affect the wearer’s motivation.

29

MINIMISING THE RISKS OF FORGETTING INSTRUCTIONS

- Aids: - videotapes
  - illustrations and printed notes
  - checklist
  - labels
  - schedules
- Repetition
- Reinforcement

97518-15S.PPT

4L397518-15

Minimizing the Risk of Forgetting Instructions

No matter how simple the care regimen, retention of the instructions is best accomplished by utilizing visual aids and demonstrations. In fact, one could argue that the simpler the care regimen, the more likely the patient will have a tendency to be lax about it.

Hearing and seeing results in about 60% information retention compared to hearing alone, which achieves only 40% retention. Coupling the instruction with a hands-on practise session ensures that it can be performed at home without supervision. Aids to instruction that minimize the risk of the patient forgetting are:

- Videotapes.
- Illustrations and printed notes.
- Checklists.
- Labels.
- Schedules (lens and case).

Asking the patient to repeat specific instructions builds their confidence and assures the clinical assistant or practitioner that the instructions have been understood. Take-home handouts and instructions organized as an information kit allow patients to review the instruction at home. Clarifications can then be made over the phone or during the next after-care visit.

Patient education should be reinforced during the after-care visits to ensure compliance to a strict care regimen.

30

UNDERSTANDING WEAR MODALITY

Explain that individual patients require different wear modalities

97518-19S.PPT

4L397518-19

Understanding Wear Modality

It is important for the patient to understand that patients have different recommended contact lens wear modalities. This serves as a precaution against changing wearing schedules as they see fit or because their friends follow schedules that appear more convenient. The different wear modalities should be defined in the handout and marked according to what is recommended for each patient. As the patient gains confidence, the desire to wear their contact lenses for extended periods of time increases. Extensions or adjustments of the wearing schedule should be discussed so the problems resulting from over-wear can be avoided.

31

ADAPTATION PERIOD

- Lens wear
- Vision care
- Maintenance routine

97518-16S.PPT

4L397518-16

Adaptation Period

The first few weeks or months of wear constitute an adaptation period. This includes adaptation to wear, vision, and care and maintenance routines. Contact lenses entail a responsibility that demands changes to the day-to-day routine of the patient.

During this period questions may arise, so easy access to the support services of the clinic should be available. This can be achieved by providing any one or combination of the following:

- Emergency phone numbers.
- Emergency names and addresses.
- Pager number.
- E-mail addresses.
- Voice messages with emergency instructions.

A list of adaptation symptoms should be provided in the handout (see later, II.C and Practical 4.3). An explanation of how adaptive symptoms differ from the symptoms that may be precursors of a complication should also be discussed. Most importantly, risk factors, contamination sources and first aid measures should also be included in the handout.

32

FOLLOW-UP AND AFTER-CARE SCHEDULE

Important for:

- Eye health care
- Patient management
- Monitoring patients

97518-17S.PPT

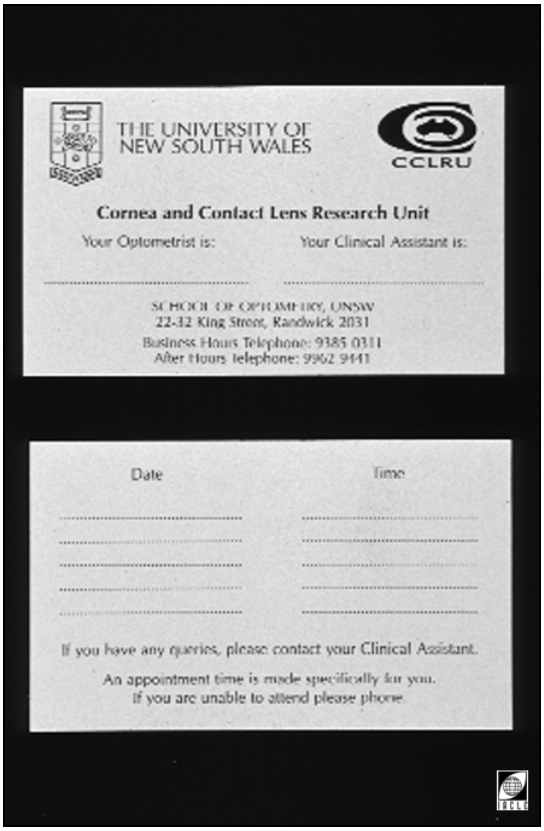
4L397518-17

Follow-Up and After-Care Schedule

After ensuring the patient understands the instructions and is able to manage the care routine without supervision, a follow-up and after-care schedule relative to the wear modality should be given. An example of such a schedule is shown in slide 33. After-care visits are steps in the continuous assessment of the patient's progress. They are intended to prevent, and in some cases correct, post-adaptation changes due to the contact lenses dispensed. Explaining the importance of these visits:

- Reduces the need for frequent follow-up reminders.
- Provides an opportunity to discuss questions or problems that may arise during the course of

33



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contact lens wear.

- Develops rapport with the practitioner and staff and thereby develops communication channels between parties.
- Reduces the risk of complications.
- Provides an avenue for continuous patient education and re-education.
- Ensures patient compliance.
- Reflects the service-oriented philosophy of the practice, which helps build patient confidence in the practitioner and staff.

Follow-up and after-care visits depend on the wear modality prescribed. For example:

SCL

- Daily wear:
  - 1 week
  - 1 month
  - 3 months
  - every 6 months.
- Extended wear:
  - after overnight wear
  - 1 week
  - 2 weeks
  - monthly for the first 3 months
  - every 3 months.

RGP

- Daily wear:
  - 1 week
  - 1 month
  - 3 months
  - 6 months
  - yearly.
- Extended wear:
  - after overnight wear
  - 1 week
  - 2 weeks
  - monthly for the first 3 months
  - every 3 months.

  - A 3 - 4 monthly follow-up for paediatric, elderly, and hyper-sensitive patients, and other SCL patients with progressive conditions and a history of complications, is recommended unless more frequent visits are required.

II.C Adaptive Symptoms

34

ADAPTIVE SYMPTOMS

- Most obvious in neophyte wearers
- Will occur in drop-outs when refitted
- Can occur in occasional wearers
- Greater with rigid lenses
- Usually only some, not all, reported
- Usually only occur in very early stages of wear

97518-20S.PPT

4L397518-20

Adaptive Symptoms

During the initial periods of lens wear, the neophyte contact lens patient will experience a range of symptoms, many of which will be novel to them.

Some of these symptoms are caused by the physical presence of the lens, others by the lens-induced perturbations of the normal physiology and functions of the anterior eye and lids. Additionally, others may be due to a retinal sensory reflex, i.e. effects of light on the retina/optic nerve (Bennett,1986). Psychological factors are probably also involved.

The duration of the ‘adaptation’ period varies according to lens type, fit, individual wearer characteristics and possibly even seasonal and climatic factors (e.g. humidity, temperature). One month would normally cover most eventualities.

A major influence on the ‘severity’ or even the occurrence of the symptoms reported is the lens type. For example, it is uncommon for a soft lens wearer to report photophobia whereas an RGP wearer is more likely to report it.

In all cases, the possibility that the symptoms reported are not contact lens adaptation-related needs to be considered. Examples include damaged or defective lenses, solution sensitivity, eyelashes under lenses, airborne contaminants entering the eye and/or becoming trapped under lenses and a range of common illnesses. The latter includes colds and influenza, viral infections, hay fever and related hypersensitivities and lid conditions such as hordeola and inward growing eyelashes (after Bennett, 1986).

Ruben (1975) suggests that physical adaptation is aided by the avoidance of physical and mental fatigue (because of their negative effects on motivation?) and that tolerance to lenses and general sensitivity are also age dependent.

If lens wear is discontinued for some time, at least some of the adaptive symptoms can be expected on resumption. If lens wear is occasional, some adaptive symptoms are possible on each occasion lenses are worn.

In a study by Pons *et al.,* 1998, it appeared that, at least with soft disposable lenses worn on a daily wear basis, vision quality (determined objectively and subjectively) did not exhibit ‘adaptation’. At the end of an 8-10 hour wearing period there was no reduction in vision and no difference between habitual and non-habitual wearers.

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ADAPTIVE SYMPTOMS
AETIOLOGY

- Presence of the lenses (FB sensation)
- Perturbations of ocular and lid physiology
  - hypoxia
  - hypotonic tears
- Retinal sensory reflex
- Psychological?

97518-21S.PPT

4L397518-21

Adaptive Symptoms: Aetiology

Contact lens wear invokes two sensory reflexes:

- The peripheral sensory reflex involving the cornea, conjunctiva and lids.
- The retinal sensory reflex involving the effects of light on the retina (optic nerve) and higher pathways (after Bennett, 1986).

Foreign body (FB) sensations are the result of the peripheral sensory reflex and, as can be readily demonstrated by the simple expedient of retracting both lids, involve the lids and not the cornea in most cases.

In a study of PMMA lens wearers, Lowther *et al.* (1970) showed that tear sodium levels (an analogue of tear fluid osmolality) varied in parallel with subjective symptoms and objective signs of adaptation. Low sodium levels were commonly associated with initial photophobia, irritation, excess tearing and even central corneal clouding. The return to prefitting levels accompanied the decline of adaptive symptoms.

The question of contact lens-induced hypoxia, which dominated contact lens research until recent times, will be covered in detail in Module 6 and will not be dealt with here. However it should be noted that hypoxia is implicated in a number of symptoms which occur during adaptation and adapted contact lens wear, especially with lenses of low oxygen transmissibility.

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ADAPTIVE SYMPTOMS

- Tearing
- Lid irritation
- Difficulty looking up
- Occasional blurring/disturbances of vision
- Reduced inclination to make extreme eye movements
- Abnormal head posture

97518-23S.PPT

4L397518-23

37

ADAPTIVE SYMPTOMS

- Excessive blinking
- Photophobia
- Headache
- Lens loss or displacement
- Tiredness

97518-24S.PPT

4L397518-24

Adaptive Symptoms

This list is adapted from Mandell (1988) and Fletcher *et al.* (1994).

- Tearing.

  Excessive lacrimation is a common experience immediately following lens insertion. While this is particularly true of RGP lenses, it also happens to a lesser extent with SCLs.

- Lid irritation/itchiness/swelling.

  This is less common with SCLs except when foreign bodies become trapped under the lens, the lens is a toric of medium to high BVP or is an aphakic lens.

- Difficulty looking up and/or to the side.

  Many RGP contact lens wearers find that looking down results in greater lens comfort. This is due largely to both lids resting *on* the lens and the elimination of the 'lid margin - lens edge' interactions. Looking up and/or to the side increases the wearer's discomfort and/or increases their apprehension about lens 'security', see Abnormal head posture/lid aperture narrowing below.

- Occasional blurring, haze, haloes.

  This is partially due to lens mobility (especially with RGP lenses) made possible by excessive lacrimation and partially due to tear-induced disturbances of the pre-lens tear film. Other tear-related problems include flare, which is usually worse at night due to increased pupil size, and tears 'bridging' the transition zone at the edge of the optic zone.

- Eye redness.

  Bulbar and palpebral hyperaemia are the result of mechanical stimulation, sub-optimal contact lens physiological performance and possibly a sensitivity to lens care product chemistry. While redness caused by the latter is more likely to worsen, the mechanically and physiologically caused hyperaemia is likely to decrease with adaptation. However they usually do not return to baseline values as long as lens wear is continued.

- Reduced inclination to make extreme eye movements.

  Some wearers fear an increased likelihood of lens loss on looking up. Further, as the lenses are likely to be mobile, they may interact with the lower lid margin excessively, or even rise with the globe and subsequently drop until stopped by the lower lid margin. As a result, patients think that if they do not look up, the discomfort will be reduced.

- Abnormal head posture/lid aperture narrowing ('squinting').

  To some extent, this is probably related to the previous point. Some wearers, fearing lens loss, believe that minimal eye movement equals minimal risk. Arguably, the financial disincentive to lens loss is less now than in previous times when individual lens costs were very significant, especially for rigid lenses.

  Additionally, lack of confidence in their ability to recentre a displaced lens (rigid or soft) makes wearers fearful of the prospect of having to do so.

- Excessive blinking.

  Frequently this is a response to the foreign body sensation experienced at lens insertion. The increased mobility of rigid lenses probably exacerbates the sensation, thereby further increasing the blink rate.

- Photophobia.

  Photophobia is not well understood. However, it has been demonstrated by Bailey (1958, in Mandell, 1988) that it is caused by lens irritation of the cornea, lids or both. Bailey relieved photophobia by anaesthetizing the cornea (and lids?).

- Headache.

  The intensity of the new experience, the concern for lens loss and other difficulties, the possible irritation by lenses (especially rigid lenses) and the resultant blinking and the lack of initial confidence may all contribute to the onset of headaches.

- Lens loss or displacement.

  Mobile lenses, abnormal head posture and eye positions, excessive lacrimation and blinking and possibly more eye rubbing all contribute to a significant possibility of lenses being lost or displaced from the eye. Adaptation results in a reduction in abnormal lacrimation, blinking and head posture thereby decreasing the likelihood of lens loss or displacement.

- Tiredness.

  A feeling of tiredness is frequently reported by inexperienced contact lens wearers. While reported by wearers of both types of lenses, the effect reported is greater for rigid lens users.

- Eyes and lenses feel dry, especially towards the end of a wearing period.

  Tears act as a lubricating film for the lids passing over the cornea, conjunctiva and contact lenses. The presence of a contact lens alters the behaviour (e.g. BUT), the physiology (e.g. osmolality) and distribution of the tear film (e.g. lipid layer of the pre-lens tear film is absent or very thin). Further, if the blink rate decreases as a result of lens wear, the evaporation rate of the aqueous phase of the tears will increase. All or some of these effects can induce feelings of 'dryness' especially if the tear film's lubricating properties are decreased.

Adaptation: Other

Some adaptation may be symptomless. It has been shown that the endothelial bleb response decreases progressively to an almost imperceptible level over one week of extended wear (Williams and Holden, 1986). The significance of this result has yet to be determined.

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ADAPTIVE SYMPTOMS
ABNORMAL

- Persistent - pain
  - haze
  - haloes
- Significant hyperaemia
- 'Spectacle blur' beyond 1 - 2 hours

97518-22S.PPT

4L397518-22

Adaptive Symptoms: Abnormal

Under 'normal' circumstances, extreme or persistent manifestations of the symptoms presented in this section should not occur. Should such manifestations occur they are indicative of more serious problems (pain, hyperaemia, vascularization) be they physical (pain, hyperaemia, prolonged spectacle blur) or physiological (haze, haloes, vascularization, spectacle blur).

While most problems are less likely to occur in soft lens wearers (except for vascularization) the potential effects of aphakic or low water toric soft

lenses should not be underestimated.

Vascularization (neovascularization) is an adverse adaptation by the cornea to hypoxic stress induced by contact lenses, especially low oxygen transmissibility soft lenses. The new blood vessels encroach into the cornea as an alternative supply line for the oxygen needed by the cornea to maintain its function at some reduced, but minimally acceptable, level.

Normally, haloes, haze, vascularization or even significant spectacle blur would not be expected with modern RGP lenses.

40

NON-ADAPTIVE SYMPTOMS

- Some lens awareness
- Some 'dryness'
- Slight redness
- Explicable vision reduction (e.g. no cylinder)
- Some 'spectacle blur'

97518-27S.PPT

4L397518-26

Non-Adaptive Signs and Symptoms

Not all sign and symptoms presented 'adapt'. Some lenses, especially rigid lenses, continue to produce some lens awareness even after successful all-day wear is achieved. Similarly, feelings of dryness and some apparent redness are reported frequently, even in 'successful' wearers.

If the patient is astigmatic (soft lenses) or has residual astigmatism (rigid lenses), yet their contact lens Rx has no cylindrical component, some reduction of acuity can be expected (cf. spectacle acuity). This less than optimum visual outcome is not a cause for concern because it is explicable. Importantly, the acuity cannot be expected to improve with wear, i.e. it will not 'adapt', unless of course some aspect of the eye changes, e.g. the corneal shape under the influence of a rigid lens.

Likewise, if a lens (rigid or soft) causes some 'spectacle blur' it is probable that, for similar wearing times, its extent will remain much the same following each wearing period because its mechanical/physiological aetiologies change little with wear, i.e. they don't 'adapt'.

Practical 4.3

(2 Hours)

Insertion and Removal of Contact Lenses

Purpose

The purpose of this exercise is to teach student clinicians how to instruct 'patients' in contact lens insertion and removal. Insertion and removal techniques for both rigid and soft lenses are described. In addition to the fundamentals of lens handling, the following will also be covered:

- Lens recentration.
- Removing debris from under lenses (soft lenses only).
- Determining when a lens is inside out (soft lenses only).
- Dealing with dropped lenses.
- The use of mirrors during insertion and removal.

Once inserted, lenses (especially soft lenses) should be relatively comfortable almost immediately. If the 'patient' is obviously uncomfortable, the student should be able to instruct them how to correct this situation by either:

- Moving the lens off centre and then recentring.
- Removing the lens and reinserting it after appropriate cleaning, rinsing or wetting, depending on whether it is a soft or rigid lens.

Particularly during the early stages of lens wear (especially with rigid lenses), new wearers are more likely to experience instances of lenses locating off the cornea immediately after insertion. Students will need to master the process of instructing the neophyte wearer in locating their lenses and recentring them, *without* the aid of a mirror.

The 'patient' should practise insertion, removal and recentration of their lenses under the guidance of their 'practitioner' during the allotted time.

Practical Session

Video presentation or demonstration by an instructor of insertion, removal and recentring procedures for both rigid and soft contact lenses.

Students should work in pairs (each taking turns at being a 'patient' and a 'practitioner') and lenses should be inserted, removed, decentred and recentred on *both* eyes.

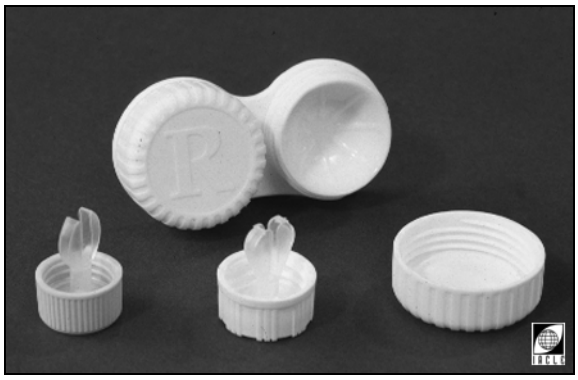
Instructions for Rigid Contact Lenses

A. Preparation

The following materials are required for this practical:

- Rigid lens trial sets or other suitable wearable rigid lenses.
- Rigid lens cleaner.
- Rigid lens combined wetting/soaking/conditioning solution (or an All-in-One solution to replace all these care products).
- Suction-type lens remover (DMV, siloxane or similar).
- Tissues.
- Tiltable table mirror.

To avoid having to replace the storage solution at frequent intervals, most rigid lens trial sets are stored dry. However, if rigid lenses are stored in a disinfecting/conditioning solution they will invariably 'wet' better when placed on the eye. Where possible, the lenses to be used should be placed in fresh storage solution well before use in this practical.



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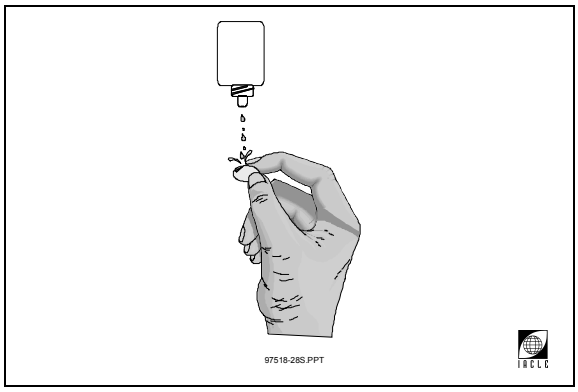
Practitioner

1. Examine the eyes of the ‘patient’ briefly to ensure that the external eye is apparently healthy.
2. Measure and record the ‘patient’s’ K readings and HVIDs.
3. Select a lens suited to their ocular parameters and record your selection.

   The BVP of the lens is of less significance.

Patient

1. Wash hands before handling any lenses.
2. Remove the chosen lens from its vial.
3. Rub and rinse the lens with sterile saline solution.
4. Apply 3-5 drops of wetting/conditioning solution to the lens.
5. Gently rub the lens for 3-5 seconds between the thumb and index finger or preferably, gently with the index finger of the dominant hand in the palm of the other hand.



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B. Insertion

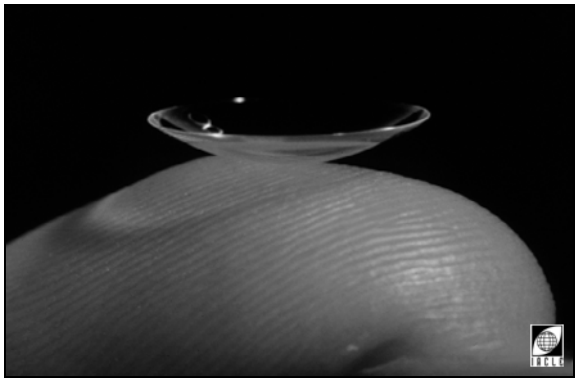
Practitioner

Stand to the side of the ‘patient’ and instruct them in the following procedures.

Patient

1. Place the lens on the leading tip of the dominant hand’s index finger which should be *dry*.
2. Inspect the lens from above and in profile, checking for obvious edge defects, chips and cracks to ensure that it is not damaged and is free of debris.

   When inspecting the lens in profile, the hand should be rotated as necessary to ensure all of the lens is examined.



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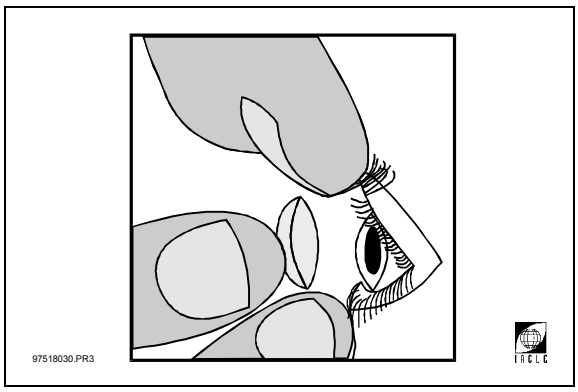
3. Fixate an object in the straight ahead position.
4. Pull the *centre* of the lower lid margin down with the *middle* finger of the hand holding the lens, making sure the eyelashes are included under the finger pad.
5. Look down and lift the *centre* of the upper lid with the *index* finger of the other hand while resting the palm of that hand on the forehead.
6. Raise the lens-carrying index finger until it, and the plane of the lens edge, are almost vertical.

   The lens should now be almost directly in front of the eye.
7. While staring *through* the lens (avoid looking *at* the lens as this involves significant convergence), gently move the rigid contact lens towards the cornea until slight 'touch' is felt.

   No further movement towards the eye is required, because the confluence of wetting solution on the lens and the pre-corneal tear film should carry the lens from the finger to the eye.



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Practitioner

Critical issues to impress upon 'the patient' are:

- The lids must not be released.
- They must not blink.
- The lens must be moved approximately along the visual axis, otherwise it will not make contact with the cornea.
- They must not 'look away' (lens avoidance) at the last, crucial moment.

Patient

1. Once the lens is successfully on the eye, look down slowly.
2. *Slowly* release the lower lid followed by the upper lid.

   Any sudden release of lids or redirection of gaze must be avoided, since the lens can be easily displaced from the eye by the 'chiselling' action of either lid margin, especially the upper one.
3. Continue looking down for a few seconds, as less discomfort is usually experienced with this posture.

Several attempts may be needed before this technique is mastered and some confidence is acquired.

After a few minutes respite, proceed to the insertion of the other lens. The same technique applies.

However the choice of hand is not universally agreed upon. Some suggest that the dominant hand be used for both eyes, while others suggest that the right hand should be used for the right eye and the left for the left, i.e. an ipsilateral approach. If marked dominance is claimed or suspected, the dominant hand should probably be used for both eyes.

If the lens powers are appropriate or nearly so, the 'patient' should be able to see fairly well as they gaze around the room. This indicates that the lens is approximately centred on the cornea. To ensure

that both lenses are centred, the monocular vision of each eye must be checked by alternatively occluding each eye (use a hand, occluder rule or other suitable occluder).

C. Locating and Recentring

With lens mobility enhanced by lid forces and lacrimation (which is common and probably unavoidable at this stage due to the relative discomfort), it is possible for the lens to be displaced from the cornea.

Practitioner

If the lens is displaced from the cornea, instruct the 'patient' in the following procedures to locate the lens.

Patient

1. Retract the lids from the bulbar conjunctiva.

   The lens is most likely to be inferiorly displaced because of the force of the upper lid (gravity is much less significant).

2. To expose the inferior *cul de sac,* look up while retracting the lower lid.

   If the lens is still not visible, then either it is located superiorly under the upper lid, or it has fallen from the eye.

3. Look down and retract the superior lid.

If the lens is located on the temporal or nasal conjunctiva, it should be easily visible.

Practitioner

To slide the lens back on to the cornea, instruct the 'patient' in the following procedures.

Patient

1. Contact the edge of the lens with the lid margin.
2. Push the lens gently towards the centre of the cornea.

   Keep the other lid retracted and the other eye open during this procedure.

Practitioner/Patient

Neither you nor the 'patient' should force the lens against the globe because this may produce a negative pressure under the lens, force the filmy conjunctiva to envelop the lens edge and result in the lens becoming immobile or even 'sucked on' to the eye. This makes removal difficult.

If the lens escapes to the side of the point of contact with the lid, the lid should be manipulated by *two* fingers with each placed on the lid on either side of the lens position. This traps the lens between two points of contact and forces it to comply with the manipulated lid movement.

The 'patient' should be warned not to force the lens edge into the limbal zone. Rather, the edge of the lens should be slid gently over/across the limbus and on to the cornea without the edge abrading or otherwise engaging the corneal surface.

D. Removal

Three techniques are used commonly, and all are presented here.

One-finger technique

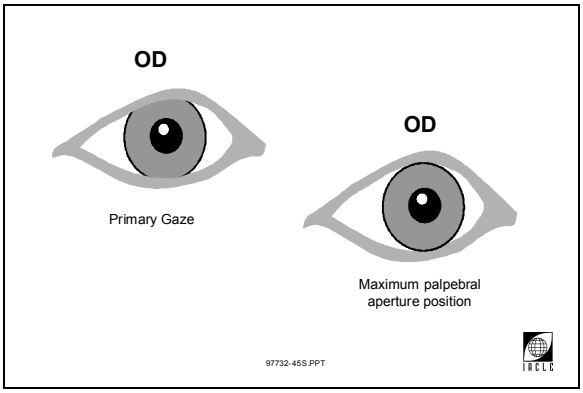
Practitioner

Instruct the 'patient' in the following procedures. It is important to ensure that their eyes remain wide open.

Patient

1. Open the eyes as in a wide staring expression while looking straight ahead.

   Sometimes it may be advantageous to look in a slightly inward and slightly upward direction depending on the lid characteristics. The 'patient' may need to experiment a little to find the technique that best suits them.



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2. Place the index finger of the ipsilateral hand at the outer canthus.
3. Pull the lid junction gently outwards in the direction of the top of the ear.
4. Blink firmly, while cupping the other hand under the eye to catch the lens as it is ejected.

Two-finger technique

Practitioner

Instruct the 'patient' in the following procedures.

Patient

1. With the index fingers of both hands, hold the upper and lower lid margins close to the upper and lower lens edges at the widest point of the lens (i.e. diametrically opposed points).
2. Gently push the lower lid upwards and inwards and towards the globe, and at the same time push the top lid downwards so that both lid margins engage the edge of the lens.

   This enables the lens to slide over the lower lid and out of the eye. The lens should now be positioned on the nail of the index finger.
3. Hold the lens with the adjacent finger to prevent it from falling.

Suction cup removal technique

Practitioner

Generally, it is unwise to supply patients with suction cups and they should probably be regarded as consulting room devices rather than wearer devices. Difficulties arise when wearers apply a cup to an eye which is *not* wearing a lens. Suction cups which do not have an air bell in the handle, thereby denying the user any control over attachment to a lens (or an eye), should be used with great caution. If a suction cup is to be used it should have a minimal suctional capacity so that if applied to the cornea or conjunctiva inadvertently, it can be removed from the ocular surface without causing damage.

After making the 'patient' aware of these drawbacks to the suction cup technique, instruct them in the following procedures.

Patient

1. Hold a suction cup between thumb and index finger.
2. Squeeze the air out and touch the lens squarely with the cup while releasing the pressure on the handle slightly.

   This causes the lens to adhere to the suction cup.
3. Remove the lens from the eye.

   If the lens resists removal, lever the handle towards one side so that one edge of the lens may lift off first and allow air under the lens.

Cleaning the lens after removal

After removal, each lens should be cleaned and rinsed thoroughly. These procedures are described in Practicals 5.1 and 5.4.

Instructions for Soft Contact Lenses

A. Preparation

The following materials are required for this practical:

- Soft lenses.
- Aerosol or preserved saline solution.
- Tiltable table mirror.
- Other lens care products if the lenses can not be disinfected thermally.

Practitioner

The aim of these instructions is to instil confidence from an early stage. For the purposes of this practical it is probably desirable to avoid lenses known to be fragile and to choose a lens of normal or greater thickness. Tearing a lens or having excessive difficulty inserting a very thin lens will defeat this aim.

1. Examine the eyes of the 'patient' briefly to ensure that the external eye is apparently healthy.
2. Measure and record the 'patient's' K readings and HVIDs.
3. Select a soft lens suited to the 'patient's' ocular parameters and record the selection.

Trial soft lenses are usually stored in either vials or blister packs. Ensure that the lenses to be used are disinfected prior to use. The vial must contain the full amount of solution which should remain clear, even after a vigorous shaking. If particulate matter or other foreign material is apparent with or without shaking, the lens must *not* be inserted, rather it should be cleaned and disinfected.

In the case of vials with crimped lids, the sealing system (cap, crimp quality, rubber seal and vial neck) should be checked for integrity before use. Trial lenses in blister packs can only be used once, unless they are returned to a clean glass (or PET) vial after a normal cleaning and rinsing step prior to disinfection.

If at all possible, trial and demonstration lenses should be disinfected thermally. Since such lenses may be stored for long (and unknown) periods, chemical disinfection systems should be avoided, especially the one-bottle care systems whose design aim is convenience, not disinfecting power.

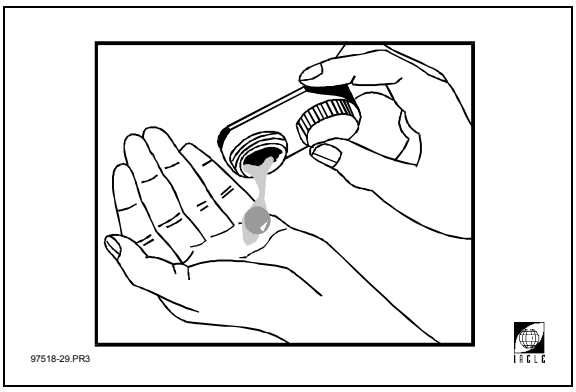
As thermal disinfection is not suitable for some lens materials, consideration should be given to storage of such lenses in unneutralized hydrogen peroxide, preferably a solution which is isotonic and of normal pH. Lenses so stored must be neutralized in advance using any approved neutralization system (liquid, tablet, catalytic disc) for the recommended time. The storage vial must not be completely sealed in order to allow any decomposition products (mainly oxygen) to escape. However, the vial must not be open to the atmosphere either, as contamination will ensue. A pressure-vented lens case is ideal.

4P30318-91

The peroxide solution should be changed every six months, even though the solution is more stable than this figure suggests. A system for recording the dates of solution changes is prudent.

Patient

1. Wash the hands and dry them with a lint-free (or as lint-free as possible) towel before handling any lenses.
2. Remove the first lens from the vial (or blister pack) by rapidly inverting the vial and spilling its contents into the palm of the other hand.



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3. Allow the excess solution to drain away.
4. *Optionally,* while the lens is in the palm of the hand (preferably convex side down) pour some sterile saline onto the lens and rub it for 5-10 seconds.

4P31306-91

5. After rubbing, rinse the lens thoroughly with more sterile saline before proceeding.

Suitable plastic stick, siloxane-tipped tweezers and other devices are also available for extracting lenses from vials. However, each carries a significant risk of puncturing the lens while it is still inside the vial where the patient's view and dexterity are both limited. Patients should be cautioned not to return spilled solution to the vial from the palm.

B. Inspection & Orientation

Practitioner

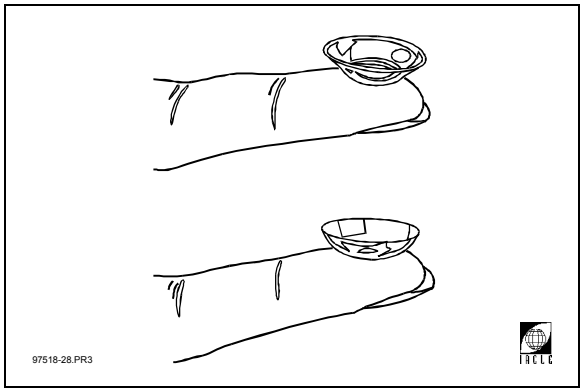
Stand to the side of the 'patient' and instruct them in the following procedures.

Patient

1. Place the lens on the leading tip of the dominant hand's index finger which should be *dry*.
2. Inspect the lens from above and in profile to ensure that the lens is not damaged or defective (see rigid lens section above).
3. After inspecting the lens, its orientation needs to be ascertained and corrected if necessary.

There are several methods of ascertaining the orientation of a lens.

For thicker or less flexible lenses it may be sufficient to simply fold the lens between the thumb and index finger and observe the behaviour of the lens edges. If the edges resist the direction of fold (edges tend to fold outwards away from each other), the lens is inside out. Conversely, if the edges readily come together the lens is correctly oriented.



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Thinner, flexible and/or 'slippery' lenses present more difficulty to most wearers. One technique involves the following steps:

1. Place the lens convex side down across the main crease in the palm of the non-dominant hand, below the base of the little finger. The palm should be dry.
2. 'Cock' the little finger.

   The crease will fold the lens.
3. Observe the behaviour of the lens edges.

This technique may be a little difficult with lenses whose surfaces are 'slippery', because the lens will tend to rise out of the crease rather than fold. In this case, the palm should be redried and the lens allowed to dehydrate a little to increase the 'grip' the palm has on the surface of the lens before retrying.

Another method involves observing the lens shape with the lens sitting in the palm convex side down and comparing it to the shape after deliberately inverting the lens.

Regardless of the methods used, some very thin medium or high water lenses present difficulties in identifying their orientation.

C. Insertion

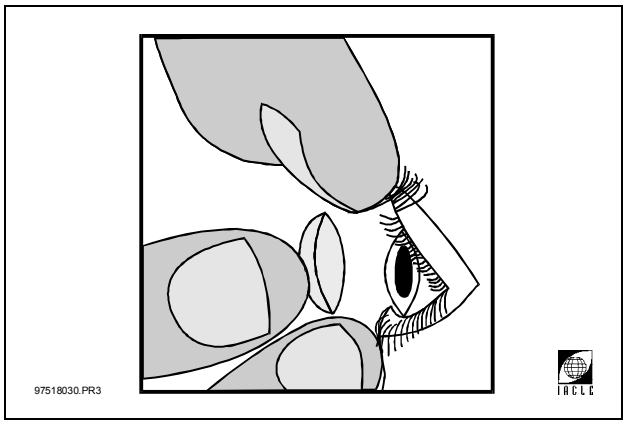
Practitioner

Instruct the 'patient' in the following procedures. The critical issues are the same as those identified for rigid lens insertion.

Patient

1. Fixate an object in the straight ahead position.
2. Pull the *centre* of the lower lid margin down with the *middle* finger of the hand holding the lens, making sure the eyelashes are included under the finger pad.
3. Look down and lift the *centre* of the upper lid with the *index* finger of the other hand while resting the palm of that hand on the forehead.
4. Raise the lens-carrying index finger until it, and the plane of the lens edge, are almost vertical.

   The lens should now be almost directly in front of the eye.



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5. Look straight *through* the lens as it is slowly and smoothly moved towards the cornea until contact is made.
6. The finger may be allowed to progress a little closer to the eye to expel some of the air from under the lens. The lens should now adhere to the eye.
7. Withdraw the finger without allowing the lens to follow.
8. Release their lower lid slowly, followed by the upper lid, so that the lens is not displaced by the force of the upper lid.

Several attempts may be needed before mastery of the technique is achieved. The size of the interpalpebral aperture created by the fingers is critical, especially where larger diameter lenses are being inserted.

Minimal discomfort should be experienced by the 'patient' because soft lenses are flexible and large. If discomfort is experienced it may mean that the lens is inside out, or that debris is trapped under the lens. Both factors are likely to result in increased lacrimation.

The second lens is inserted using the same basic technique. The choice of which hand is to be used should involve a discussion with the 'patient'. A simple trial and/or brief discussion will usually resolve the issue.

D. Locating and recentring

Little recentring is required with well fitted soft lenses. They are inherently self-centring, provided there is sufficient tear fluid to facilitate lens movement and the displacement from the cornea is not excessive.

Practitioner

If the lens is displaced from the cornea, the 'patient', should know how to locate it. Soft lenses are more likely to be superiorly displaced. Occasionally a soft lens may be folded as well. Instruct the patient in the following procedures.

Patient

The 'patient' can locate the lens by retracting the lids from the bulbar conjunctiva. To expose the superior bulbar conjunctiva, they should look down as the superior lid is retracted.

To search for the lens under the lower lid, the 'patient' should look up while they retract the lower lid.

If the lens is displaced, the 'patient' should:

1. Touch the centre of the lens with the tip of their index finger while retracting the relevant lid.
2. Gently slide the lens towards and onto the cornea until it is centred.

If the lens is folded and displaced:

1. Remove it.
2. Rinse it.
3. Ensure it is the right way around.
4. Reinsert it.

Because soft lenses are large, it is sometimes possible to recentre the lens (particularly if it is laterally displaced) by merely looking in the direction of the lens.

E. Removing debris from under a lens

Practitioner

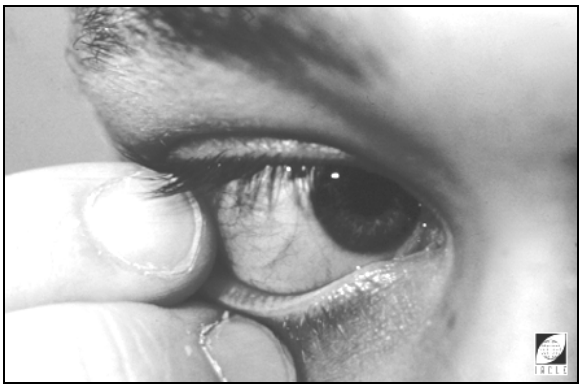
Instruct the patient in the following procedures.

Patient

1. Look straight ahead.
2. Place the tip of the index finger on the centre of the lens.

   A mirror may be useful at this stage. However its usefulness at subsequent stages is questionable.
3. Gently pull the lens temporally while *simultaneously* directing the gaze nasally.

   The lens will now be off the cornea on a large area of exposed temporal bulbar conjunctiva.



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4. 'Orbit' this zone with the lens while maintaining the gaze nasally.

   After a few seconds of lens movement, propel the lens towards the cornea.
5. Look straight ahead.

   The lens should be self-centring and no further lens manipulation should be required.

If the lens is still uncomfortable, the process can be repeated. If two attempts are still unsuccessful, the 'patient' should be advised to remove and inspect the lens. If the lens is apparently undamaged, it can be reinserted following rinsing.

F. Removal

Squeezing technique

Practitioner

Instruct the patient in the following procedures. Caution the 'patient' about allowing fingernails to contact the lens and the possibility of them puncturing the lens.

The choice of using the dominant hand for both lenses or the ipsilateral hand for each lens should be made after appropriate discussion and/or trial with the 'patient'.

Patient

1. Ensure that the lens is centred on the cornea before attempting to remove it.
2. Look nasally.
3. Retract the lower lid with the middle finger of the ipsilateral hand and the top lid with the middle finger of the contralateral hand.
4. Locate the centre of the lens with the index finger (ipsilateral).
5. Slide the lens onto the temporal bulbar conjunctiva.
6. Direct the gaze nasally.
7. While holding the lids apart, squeeze the lens gently between the thumb and index finger until the lens starts to fold *in situ,* allowing air under the lens.
8. Without releasing the hold on the lens, withdraw the fingers from the eye, bringing the lens with them.
9. Maintain the removed lens in the prescribed manner.

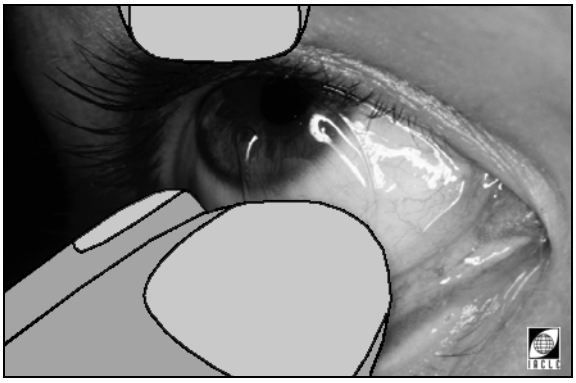
   This is covered elsewhere (see Practicals 5.1 and 5.3).

   After preparing the first lens for disinfection, remove the second lens and care for it in the same manner.

Alternate technique

Patient

1. Look up rather than straight ahead.
2. Retract the lower lid with the middle finger.
3. Slide the lens *down* with the index finger.
4. As soon as the lens is halfway off the cornea, squeeze the lens with the thumb and index finger and remove it in the manner described previously.



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Scissor technique

Patient

1. Look straight ahead.
2. Hold the upper and lower lids apart at the midpoint of the lid margins.
3. Gently stretch the lids until the lid margins engage the lens edges.
4. Continue the lid stretching until the lens is squeezed from the eye.

Dealing with dropped lenses

At the very least, a dropped lens should be thoroughly rinsed in sterile saline initially *without* rubbing. This prevents abrasive contaminants scratching the lens surfaces. This rinsing-only step should be followed by a thorough rubbing and rinsing step.

Ideally, the whole cleaning and rinsing cycle should be applied to a dropped lens. A rinsing-only step should precede all other steps in order to rid the lens of abrasive particulate matter.

In the absence of other sterile solutions, it is acceptable to use an in-eye comfort drop as an emergency measure. Except in the case of unit-dose products, such products have a discard-after-opening recommendation which is usually 30 days.

Mirrors

There are many opinions among contact lens practitioners on the use of mirrors during lens handling. However a practitioner must always be aware of the difficulty a mirror-using wearer will face in a lens emergency if no mirror is available. While mirrors may be useful initially (less so with hyperopes and/or presbyopes), wearers should be encouraged to overcome their dependence on them as soon as possible.

Some practitioners refuse to use mirrors at any stage, even during the patient's initial attempts at insertion and removal.

If a mirror is used, it should be flat (as opposed to a magnifying type) and tiltable with a broad base for stability. Some experimentation may be required to find the ideal mirror position and angle.

Other aids such as suction cups with torch lights built into their centre may be useful for extreme ametropes or even sub-normal vision cases. Such cases should be treated on an individual basis and adaptations to circumstances made as appropriate.

Adaptive symptoms for rigid and soft lenses include:

- Tearing.
- Lid irritation.
- Difficulty looking up.
- Occasional blurring or disturbances of vision.
- Reduced inclination to make extreme eye movements.
- Abnormal head posture.
- Excessive blinking.
- Photophobia.
- Headache.
- Lens loss.
- Lens displacement.
- Tiredness.

Each of these is detailed in Lecture 4.3, Section II.C.

These symptoms and, on rare occasions other symptoms not listed here, are possible outcomes of the commencement of contact lens wear. With some patients it may be prudent to forewarn them of what they might reasonably expect to experience. In presenting such a list it should be tailored to the lens type, the level of patient apprehension and the practitioner's experience with the particular lens design and material. There is no reason to present a full list of possibilities as this might discourage the patient. Further, there is, arguably, no valid reason for a full list being presented since not all are applicable to a particular patient/lens combination. In the case of patients exhibiting symptoms of hypochondria, it may be unwise to raise any possibilities as they may prime the patient's imagination. In exercising discretion in the matter of what to 'tell' the patient, the practitioner is demonstrating the 'art' of clinical practice.

🕮 References

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Unit 4.4

(2 Hours)

Lecture 4.4: Conducting the After-Care Visit

Course Overview

Lecture 4.4: Conducting the After-Care Visit

I. The Case History

II. Conducting an After-Care Examination

III. Review of Lens Care and Maintenance During the After-Care Visit

IV. Symptomatology in After-Care

V. Success Criteria

Lecture 4.4

(2 Hours)

Conducting the After-Care Visit

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III After-Care Examination Procedures **109**

IV Review of Lens Care and Maintenance **115**

V Symptomatology in Contact Lens After-Care **118**

VI Success Criteria for Soft and Rigid Lens Wear **122**

I After-Care Pro-Forma

An Example of an After-Care Pro-Forma is provided on the following pages.

After-Care

Visit No. _____ ☐ scheduled ☐ unscheduled

Patient _____ Date _____

History WT Today _____ Usual WT _____ hours (WT = Wearing Time)

Lens Name OD _____ OS _____

Care System _____ Compliance _____

Enzyme _____ How often ? _____ Last used ? _____

Vision ☐ Comfort ☐ Insertion/Removal ☐ Other ☐ Lens age OD _____ mth/yr

CC OS _____ mth/yr

Change in health?/medication?/allergies? _____

With Lenses On	**OD**	**OS**
Visual Acuity	6/ Near	6/ Near
Retinoscopy	6/	6/
Over- Rx	6/	6/
FSK (RGP)	_____ / _____ _____ x _____	_____ / _____ _____ x _____
Mire Appearance (SCL)	before blink _____ after blink _____	before blink _____ after blink _____
RGP Lag _____ SCL Lag Str. Ahead _____ Sup. Gaze _____	Position Cornea	RGP Lag _____ SCL Lag Str. Ahead _____ Sup. Gaze _____	Position Cornea
Biomicroscopy Indicate nicks, tears, scratches transient films	Lens	Lens
Fluorescein Pattern (RGP) Centre Mid-periphery Edge	Lens	Centre Mid-periphery Edge	Lens

With Lenses Off	**OD**	**OS**
Biomicroscopy - See reverse for details		
Pachometry	mm	mm
Keratometry	_____ / _____ _____ x _____ mm _____ / _____	_____ / _____ _____ x _____ mm _____ / _____
Retinoscopy	6/	6/
Balanced Subjective	6/	6/
Verification of Lenses		
Inspection of Lenses		

Summary of Visit

Assessment (problems)

Plan

Photos taken ? ☐ Yes ☐ No

Next appointment date:

Recall 3 months / 6 months / yearly

Modifications	OD	OS
Name	_____	_____
BOZR	_____	_____
BOZD	_____	_____
BPZD	_____	_____
TD	_____	_____
BVP	_____	_____
t_c	_____	_____
Other	_____	

Change of Address/Tele. No

_____

_____

_____
Student

_____
Supervising Clinician

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Modified from an original in use at the School of Optometry, University of Waterloo, Canada

Quantification of Slit Lamp Observations

SECTION A: Slit Lamp Examination

OD ☐ All Negative | OS ☐ All Negative

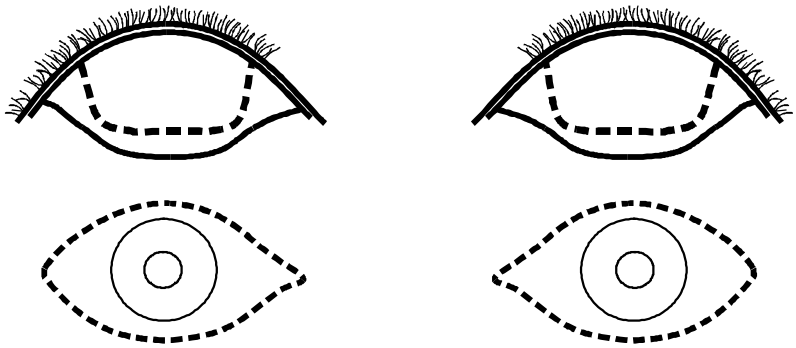
Absent	☐	Present			☐	Corneal Striae	Absent	☐	Present		☐
Grade	0	1	2	3		Corneal Oedema	Grade	0	1	2	3
Grade	0	1	2	3		Corneal Neovascularization	Grade	0	1	2	3
Grade	0	1	2	3		3 and/or 9 o'clock Corneal Staining	Grade	0	1	2	3
Grade	0	1	2	3		Other Corneal Staining	Grade	0	1	2	3
Grade	0	1	2	3		Epithalial Microcysts	Grade	0	1	2	3
Grade	0	1	2	3		Limbal Injection	Grade	0	1	2	3
Grade	0	1	2	3		Bulbar Injection	Grade	0	1	2	3
Grade	0	1	2	3		Bulbar Oedema	Grade	0	1	2	3
Type	0	1	2	3		Tarsal Conjunctival Abnormalities	Type	0	1	2	3

SECTION B: Other Anterior Segment Abnormalities

OD ☐ All Absent | OS ☐ All Absent

Instructions: If abnormalities are present, indicate cause(s) by checking appropriate box(es) and note location in diagram below

(1) Lens Related	(2) Solution Related	(3) Result of Other Factors (explain)		(1) Lens Related	(2) Solution Related	(3) Result of Other Factors (explain)
☐	☐	☐ _____	1. Blepharitis	☐	☐	☐ _____
☐	☐	☐ _____	2. Corneal Infiltrates	☐	☐	☐ _____
☐	☐	☐ _____	3. Iritis	☐	☐	☐ _____
☐	☐	☐ _____	4. Corneal Ulceration Confirmed By Microbiological Culture	☐	☐	☐ _____
☐	☐	☐ _____	5. Other (Explain)	☐	☐	☐ _____



SECTION C: Comments and Additional Tests (eg. photography)

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II Case History

1

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2

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Conducting the After-Care Visit

After-care visits are consultations after contact lenses have been dispensed and wear has commenced. At such visits, progress is evaluated and the condition of the anterior eye and contact lenses are monitored. This is done to prevent complications arising and to treat any abnormality detected. After an initial settling and monitoring period, follow-up and after-care visit schedules are commonly six monthly to yearly with most cases. However complicated or problem cases may require more frequent visits. Lens fitting and/or Rx changes may be required in the longer term. Complications, which can arise from many causes, can be either symptomatic or asymptomatic.

An overview of the after-care visit appears opposite.

The recommended sequence of after-care procedures follows (Fonn, 1992).

With lenses ON:

- History.
- Posture and blinking.
- Visual acuity.
- Retinoscopy.
- Over-refraction.
- FSK (Front Surface Keratometry of the contact lens *in situ*).
- Assessment of lens performance
  - fluorescein pattern
  - centration
  - movement.
- Assessment of lens surface
  - wettability
  - deposits.

With lenses OFF:

- Slit-lamp biomicroscopy.
- Keratometry.
- Retinoscopy.
- Refraction.
- Visual acuity.
- Examination of lenses
  - deposits
  - surface and edge inspection
  - parameter measurement.

A flow chart of the sequence of an after-care visit for RGP lenses with and without complications was presented by Fonn and Gauthier (1990). A similar flow chart for SCLs can be devised.

3

CASE HISTORY

- Contact lens details
- History of visits
- Ocular and medical history
- Symptoms/complaints
- Patient's assessment of lens wear
- Wearing time
- Other issues arising

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Case History

Primarily, a progress history is taken to communicate to the examiner the wearer's impressions of the success or otherwise and experiences of contact lens wear in the period since the last consultation. Such impressions also provide guidance (albeit subjective) as to which additional procedures it may be prudent to perform. Progress history also ensures that specific concerns expressed by the wearer are addressed. Although a standard examination routine is recommended, information derived from the history may indicate the need for an investigation of a specific aspect of the eye or vision. The following information should be recorded prior to any examination:

- Contact lens details (e.g. key parameters, wear modality, etc.).
- A history of visits (e.g. times, dates, visit number) is necessary to track progress and document the history of wear.
- An ocular history may reveal problems experienced by the wearer when using contact lenses.
- A medical history may reveal other treatments or physical or systemic conditions that may have some bearing on the findings during the after-care visit.
- Symptoms and other complaints. Unless specifically questioned, patients may forget minor, temporary or transient symptoms or complaints. Prevalence, onset, duration and predisposing factors should be investigated.
- Subjective assessment of lens wear. Record quality of vision, comfort, ease of handling and impressions of the care regimen.
- Wearing time in hours per day and days per week should be recorded as a gauge of progress. It is often an indication of the actual level of 'success' and if less than expected, the reason(s) needs to be explored. If greater than advised, does it constitute overwear? If limited wearing time is desired, e.g. social wear or sports, this should be noted.
- Note patient-specific conditions that may be relevant to the examination's findings (e.g. the need for a shortened wearing time, special medications or applications, engagement in a specific activity, etc.).

4

THE INTERVIEW

Vary approach for:

- Children
- Elderly patients
- Hypochondriacs
- Speech-impaired patients
- Hearing-impaired patients

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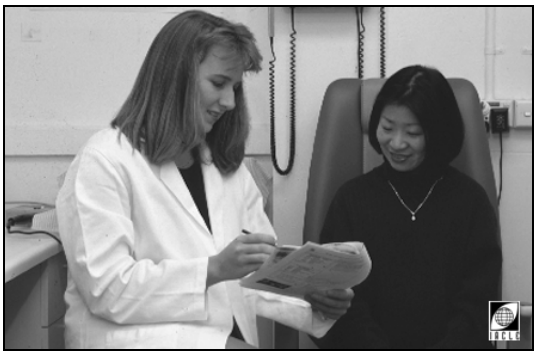

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The Interview: Interviewer-Interviewee Process

While the interview process is aimed at soliciting information that can improve the level of patient care, the interviewer must always be receptive to unsolicited information which may prove to be of great value. The interview can be conducted over the telephone or face-to-face. It differs little from those conducted during earlier visits except for its aim of ascertaining what symptomatology (if any) may be contact lens-related. Aside from the various details mentioned above, family and personal information may provide further insight into the patient's perspective and is also useful in that attempts to elicit it demonstrate concern for the total well being of the patient. The information derived from patients can vary depending on the level of trust, confidence and rapport that the practitioner and/or clinical staff have established. Ideally, the approach and attitude should be varied according to the needs and personality of the patient:

- Children.

  Children often find it difficult to express what they feel. Simple language and examples help them communicate what they may be experiencing. It may also be easier for children to associate with mascots or characters in motion pictures or cartoons. Kindergarten, Illiterate E and Landolt C visual acuity charts are useful with young children, especially if there is a language or cultural barrier as well.

- Elderly patients.

  Older patients like to talk about how they are feeling. A suitable level of concern on the part of the practitioner helps to build a good practitioner-patient relationship, and is probably one of the main aspects elderly patients look for in their health care providers.

- Hypochondriacs.

  Overly sensitive patients are difficult to deal with because their complaints may be based on underlying fears and insecurities rather than clinical difficulties, or may be disproportionately related to the underlying cause (if any). Reassurance should be given during the interview and after the examination to allay any doubts that the patient may have. However, with such people excessive fuss over details may be unwise, as it may fuel their problem rather than help manage it.

- Patients with verbal disability.

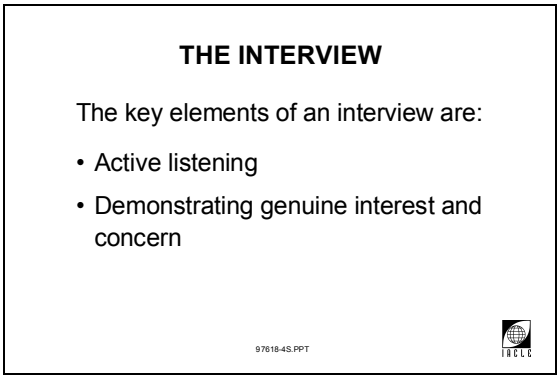
  When verbal communication is not possible, other means need to be employed to question patients about how they feel. Sign language, writing, hand gestures and facial expressions are useful ways to facilitate communication. General body language should also be

observed as it is frequently the most efficient and least fatiguing method of both gross and subtle communication. A family member is often useful as an intermediary between the practitioner and patient.

- Patients with hearing disability.

  Any interview should maintain the privacy of patients, especially those with hearing disabilities. When conversation volume needs to be increased, conducting the interview in another room away from the hearing of others (e.g. patients in the waiting room are often just a wall away) will help make the patient less inhibited and more open, and result in a better quality of communication.

6



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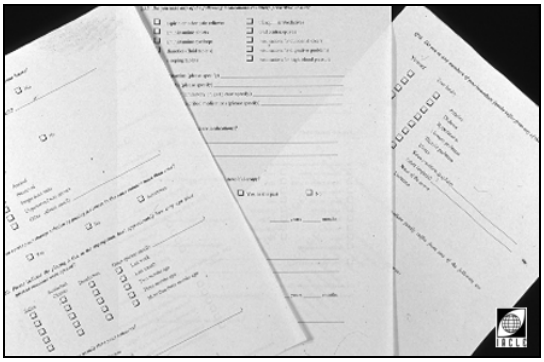
The Interview

Developing Skills

Good interviewing skills can be developed. Being a good listener and showing genuine interest and concern are the key elements of conducting a good interview. There are a number of ways in which a good interview can be conducted by the practitioner or clinical assistant:

- Prepare a list of all the essential issues, questions and other information which need to be raised with the patient.
- Ensure the record card's design facilitates easy recording and has enough space for comments.
- To aid patient openness, the introduction should be casual, unhurried and aimed at putting the patient at ease prior to the interview proper commencing. Keen observation skills may provide clues to issues (e.g. the condition of the lens case) that should be raised subsequently.
- Adjust the terminology used to suit the patient.
- Photographs, illustrations and diagrams (often available from optical/contact lens manufacturers) are useful in helping patients describe a transient symptom or observation they may have made.

7



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The interview proper should encompass most or all of the following:

- Wearing time on the day of consultation as well as the 'usual' wearing time.
- Patient's impression of their:
  - lens comfort
  - vision quality
  - eye health
  - general health.
- Medications, allergies, etc. which may be relevant.

- A discussion of expected and abnormal adaptive symptoms.

- Lens care products used, the frequency of their use and the apparent level of patient compliance with lens care instructions. Are the recommended lens care products being used? If protein remover has been prescribed, is it being used and in the manner recommended?
- Age(s) of the lenses. How do the reported figures fit with the replacement schedule (if any)?
- Competence at insertion and removal (claimed or demonstrated).

III After-Care Examination Procedures

8

AFTER-CARE EXAMINATION PROCEDURES

- *With* contact lenses
- *Without* contact lenses

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9

AFTER-CARE PROCEDURES

Lenses ON

- Visual acuity
- Retinoscopy
- Front Surface Keratometry
- Lens behaviour *in situ*
- Biomicroscopy
- Lens integrity
- Fluorescein pattern (RGPs)

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After-Care Examination Procedures

Where there is no apparent contra-indication, patients should be advised to wear their contact lenses when they attend after-care visits. This allows the practitioner to make an evaluation of the lenses *in situ* after several hours of lens wear. If patients are having difficulties wearing and/or adapting to their lenses they should *not* be coerced into wearing them to the after-care visit in case there is a serious underlying cause for the difficulty. Under such circumstances, the patient should present their lenses for inspection before insertion is attempted. It is useful to ascertain whether the problem is unilateral or bilateral.

Differences in fitting, vision and comfort between the after-care and dispensing visits should be carefully noted. Any significant difference is reason to suspect the existence of a problem arising during the adaptation period, e.g. corneal curvature changes, alterations in lens fit (see Unit 5.4, and Dormon-Brailsford, 1974).

A standard protocol for an after-care examination might include all or most of the following. Where possible, findings should be recorded diagrammatically.

With contact lenses ON

- Visual acuity. Monocularly and binocularly.
- Retinoscopy and over-refraction. The latter can be either a best-sphere result or a full sphero-cylindrical subjective. The result recorded should mirror a balanced binocular refraction.
- Front Surface Keratometry (FSK or Over-keratometry). The flexure of an RGP lens *in situ* can be ascertained by a keratometer (ophthalmometer) or a videokeratoscope. With SCLs, a qualitative assessment of their fitting behaviour can be also be made with a keratometer by noting the quality of the instrument mires reflected by the pre-lens tear film (PLTF). Behavioural changes induced by blinking are also important.
- Lens behaviour *in situ,* regardless of lens type should be assessed. Rest position, lag in straight ahead and up-gaze eye positions, and effects of a blink should all be observed and recorded (diagrammatically if possible).
- Biomicroscopy (see Unit 4.5). With the lenses in place, the slit-lamp can be used to study any obvious effects the lenses have on:
  - limbal vessels
  - the conjunctiva under the lenses, especially at their edges
  - the lids and the lid margins.
  - In the case of RGPs, their physical

relationship with the lens edges.

- the PLTF, its BUT and any distinguishing characteristics such as repeatable dry spots, mucoid floaters and particulate matter
- the post-lens tear film.

Evaluation of the anterior eye proper is best performed with the lens off.

- Lens integrity. Seeking evidence of lens damage and assessing lens condition is a routine pursuit which increases in importance when discomfort or irritation is reported.
- In the case of RGP lenses, the fluorescein pattern could also be assessed and the findings recorded diagrammatically. Some practitioners prefer to use a Burton lamp to assess the fluorescein fitting pattern. However, the spectral transmission characteristics of some RGP lens materials render the Burton lamp approach impossible.
- Photograph appearances of interest. A film tracking system will be required if returned images are to be matched to the relevant patient file.

10

AFTER-CARE PROCEDURES

Lenses OFF

- Biomicroscopy
- Keratometry
- Retinoscopy
- Lens verification
- Inspection of the lenses *in vitro*
- Other tests as appropriate

97618-24S.PPT

4L497618-24

With contact lenses OFF

- Biomicroscopy.
- Keratometry, videokeratoscopy.
- Retinoscopy.
- Refraction, monocular and binocular.
- Lens verification. Confirm the lens to be what was originally delivered. With stock lenses, this is often a matter of simply inspecting and confirming the lens markings and measuring the BVP. Rigid lenses require considerable more effort because of the greater number of key parameters, e.g. BOZR, TD, BVP, BOZD, etc.
- Inspection of the lenses *in vitro*. This step is more important when the symptomatology suggests lens condition as a possible cause of wearer discomfort.
- Other tests as appropriate.

11

AFTER-CARE EXAMINATION *WITH* CONTACT LENSES
VISUAL ACUITY

- No problem reported
- Some 'blur' reported
  - onset
  - frequency
  - quality

97618-6S.PPT

4L497618-6

With Contact Lenses ON: Visual Acuity

Visual acuity testing should be performed monocularly and binocularly, at both distance and near, regardless of the complaints (if any) presented by the patient. When complaints about vision are made, other issues which might be investigated include:

- Onset of blur (time and condition).

  Blur that occurs in the morning may be due to excessive lacrimation upon insertion, or in the case of extended wear patients, corneal swelling, mucus, etc. Blurring during the day may be due to dehydration (SCLs) especially when exposed to drying from wind, air conditioning, room heating, etc. Rigid lens wearers may experience blurring from excessive movement or decentration. Ghost images (flare) may be seen when excessive lens decentration causes the transition zones to encroach onto the pupil area.
- Frequency of blur (fluctuating, intermittent, consistent).
- Quality of blur (haziness, distortion, etc.). Corneal oedema and incorrect BVP blur vision in characteristic ways. Similarly, toric lens axis mislocation will also affect vision quality adversely.

12

AFTER-CARE EXAMINATION *WITH* CONTACT LENSES
OVER-REFRACTION

- Retinoscopy
- Subjective refraction
- Autorefractor
- Consider binocular issues

97618-7S.PPT

4L497618-7

With Contact Lenses ON: Over-Refraction and Retinoscopy

Retinoscopy and refraction over contact lenses provide measures of the accuracy of the BVP prescribed. When the subjective refraction is inconsistent or inconclusive, an autorefractor, or even a retinoscope, may provide additional information. Further, an autorefractor is invaluable when examining children, the elderly and patients with speech or hearing impairments.

When a difference between the subjective and objective results is found, the possible involvement of binocular issues should be suspected. In this circumstance, the final prescription issued may require clinical judgement and a measure of experience.

13

AFTER-CARE EXAMINATION *WITH* CONTACT LENSES

FSK
↓
Flexure
↓
Residual astigmatism

thicker lens RGP (Dk/*t*)? | toric lens RGP & SCL

97618-8S.PPT

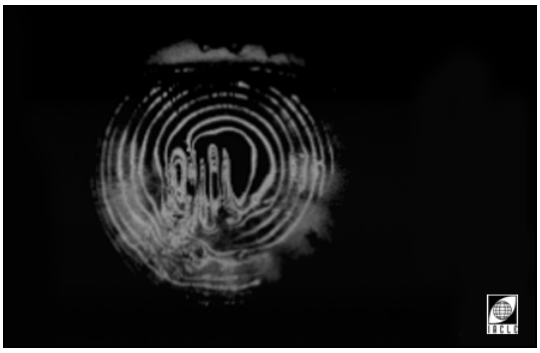
4L497618-8

With Contact Lenses ON: Front Surface Keratometry/Photokeratoscopy

Front surface keratometry (FSK, keratometry of the front surface of contact lenses or over-keratometry) is conducted to determine how much corneal astigmatism is translated to the front surface of an RGP contact lens *in situ*. While lens flexure also occurs with soft lenses, modern SCLs translate almost all corneal astigmatism to the front surface. Consequently, little useful information can be gleaned from FSK measurement.

RGP lens flexure can be reduced by increasing lens thickness. However, this will also reduce oxygen transmissibility.

14



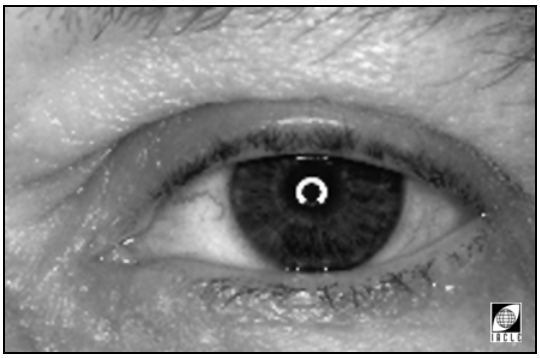
4L40227-91

Other options are:

- A more rigid lens material of the same thickness and Dk (or even higher).
- A thicker lens with a higher Dk material to maintain lens transmissibility.

Surface contamination may also result in irregular surface keratometry (by rendering the reflecting surface irregular) and blurred vision. Similarly, wrinkling of soft contact lenses can be seen as a distortion of mire images during keratometry and photokeratoscopy (slide 14).

15



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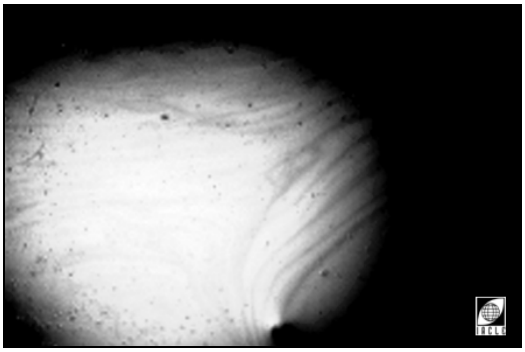
With Contact Lenses ON: Blink Evaluation

Alterations to a wearer's blink pattern and palpebral aperture are common, especially with RGP lenses. RGP lens wearers tend to increase blink frequency, an effect that is less common with SCLs. Several investigators (Sheldon *et al*., 1979; Molinari, 1983. Fonn and Holden, 1986; Fonn and Holden, 1988) have also reported the development of a partial lid ptosis over time with rigid lens wearers (slide 15 shows partial ptosis with some upper lid swelling).

Although excessive blinking does not have any serious adverse effects, it can induce feelings of fatigue.

The completeness of a blink also needs to be assessed. It is of particular importance when band-like deposit patterns are observed on the front surface of lenses. Blink completeness is particularly important to wearers of toric soft lenses. Toric soft lenses worn by an incomplete blinker will eventually exhibit a band-shaped deposit which delineates the 'gap' between lids when the lids are 'closed' (incompletely) during a blink.

16

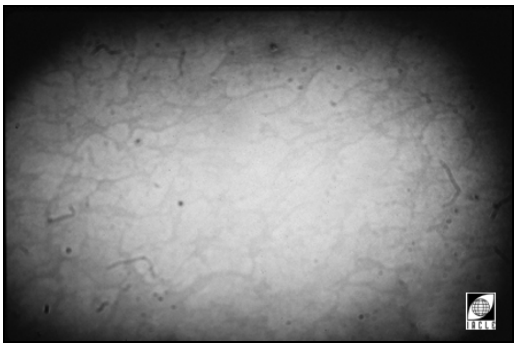


4L40120-93

With Contact Lenses ON: Tear Evaluation

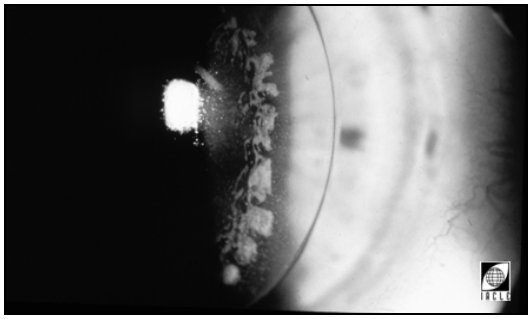
The tear film is examined to determine its stability, surface characteristics including flow, colour fringing and particulate matter, and overall appearance. If contact lens wear causes tear film instability, the use of viscosity-enhancing eyedrops may help, at least temporarily. An examination of the tear film's lipid layer during lens wear may show it has thinned and demonstrates a stable flow pattern (slide 16) or even a non-mixing and unstable open meshwork (slide 17). This suggests increased evaporation as a possible cause of dryness symptoms.

17



4L42156-93

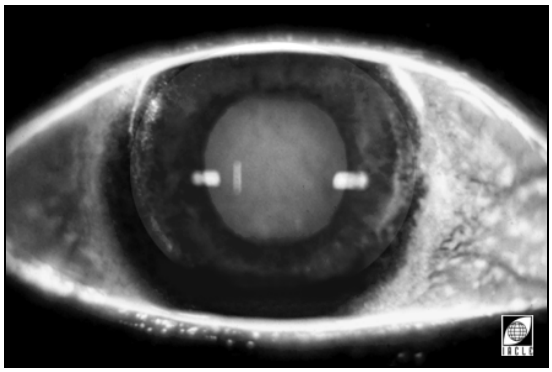
18



4L40136-91A

With RGP lenses, retention of fluorescein-stained post-lens tears for many minutes suggests a low tear exchange rate (or even stagnation). This indicates that the lens/cornea relationship needs to be altered. Either the BOZR needs to be flattened or the back surface design altered (peripheral and edge curves made flatter) or both. Trapped post-lens tear film debris is usually indicative of a tight fitting lens (slide 18).

19



4L40671-94A

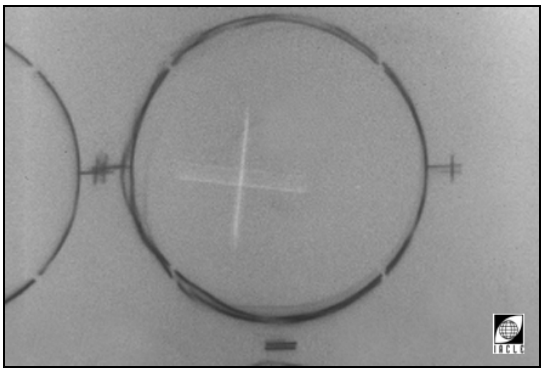
With Contact Lenses OFF: Biomicroscopy

Biomicroscopy is probably the most important part of an after-care visit because it facilitates an objective determination of any corneal insult resulting from contact lens wear.

Fluorescein is instilled into the anterior eye to disclose any tissue damage. Tissue damage is seen as yellow fluorescent areas which may vary in size from punctate (point-like) to significant areas of apparently sheet-like (continuous) staining. Generally, areas of damage, regardless of size, are referred to simply as 'staining' whether viewed in white or blue light. The type of staining is often characteristic of its aetiology, e.g. adherent rigid gas permeable lenses produce corneal indentations seen as 'compression rings', see slide 19.

NOTE: Fit assessment is covered in Module 3.

20



4L43064-93

With Contact Lenses OFF: Keratometry/Videokeratoscopy, Photokeratoscopy

Keratometry, videokeratoscopy or photokeratoscopy should be performed routinely after contact lens removal. If significant changes in lens fit were evident from the fluorescein pattern, either the corneal curvature, lens shape or both have changed. The cause(s) need to be determined. While corneal curvature changes are now uncommon, the practitioner needs to confirm any variations noted and try to determine whether they are contact lens-induced or not. Corneal mapping systems cover much more of the corneal area than keratometers (approximately the central 3 mm) and may provide more useful information. The clarity of mire images should be noted. Where

corneal distortion is apparent, some level of 'spectacle blur' or vision decrement can be expected, and this should be investigated during refraction. Slide 20 shows mire image distortion indicative of contact lens effects on corneal surface shape.

21

AFTER-CARE EXAMINATION
***WITHOUT* CONTACT LENSES**
REFRACTION

- Compare baseline & after-care data
- Consider: - FSK result (lens flexure)
  - over-refraction
  - keratometry (baseline)
  - keratometry (without)

97618-9S.PPT

4L497618-9

With Contact Lenses OFF: Retinoscopy and Refraction

Retinoscopy, subjective refraction and/or autorefraction without lenses may provide some insight into the effects of contact lens wear on the eye. Data acquired at the after-care visit is compared with the baseline results found during the preliminary examination. Over-refraction data, particularly any residual astigmatism, also needs to be considered when comparing baseline and *without*- lens results.

Especially in the case of RGP lenses where astigmatism may be corneal and internal, the analysis of results can be complex and may require a good working knowledge of optics. This is more so if FSK results also show *in situ* lens flexure. The cause of discrepancies needs to be ascertained.

If the best spectacle acuity after contact lens removal is reduced i.e. 'spectacle blur', and corneal distortion or warpage is suggested by keratometry, it is likely that the lenses need to be altered to reduce their untoward effect on the cornea.

22

4L40042-96

23

4L40102-95

With Contact Lenses OFF: Other Tests

The following additional tests may be useful (if the equipment necessary is available). As with the preceding tests, findings should be compared with the preliminary (baseline) data:

- Pachometry (slide 22).
- Corneal sensitivity (e.g. Cochet-Bonnet aesthesiometry, slide 23).
- Tear film assessment.
- Lens parameter verification.
- Lens inspection *in vitro.*
- Other tests may be required on an 'as and when required' basis. Selection may require clinical judgement and some experience.

IV Review of Lens Care and Maintenance

24

REVIEW OF LENS CARE AND MAINTENANCE

- Lens handling
- Solution use
- Hygiene
- Additional instruction

97618-10S.PPT

4L497618-10

Review of Lens Care and Maintenance

While a comprehensive lens care review need not be conducted at every after-care visit, take the opportunity to review the issues and re-educate as necessary, regardless of the patient's experience. Aspects of the care regimen that may need reinforcement can usually be determined easily during the interview. Obvious clues, e.g. a dirty lens case, should be noted and the matter pursued when appropriate.

Care and maintenance is discussed in Module 5.

In this section, care and maintenance will be reviewed:

25

LENS HANDLING

- Confirm safety and proficiency
- Confirm proper cleaning and disinfection
- To 'encourage' compliance, use approach appropriate to patient

97618-11S.PPT

4L497618-11

Lens Handling

By the time patients return to the clinic for their first after-care visit, they should be capable lens handlers. Individual techniques may have been developed and the practitioner should evaluate the safety of the methods employed. The need for additional aids, such as a lens applicator or mirror, is usually apparent quite early.

Initiate a conversation about proper cleaning and disinfection by asking, 'What difficulties have you encountered with the cleaning procedure?' Avoid questions requiring simple YES or NO answers (i.e. closed probing), e.g. 'Did you have any difficulties cleaning your lenses?'. Patients will usually answer NO, just to avoid answering any further questions and to imply they have mastered the subject.

Alternatively, the patient may volunteer information to the practitioner or clinical assistant about which steps they are unsure of. Openness and frankness should be encouraged actively (by suggesting they be forthcoming) and passively (by the 'style' and friendliness of the practitioner and staff).

The approach taken, casual and relaxed or authoritarian, depends largely on an interpretation of the attitude of the patient. With careless, inattentive, reckless or neglectful patients, a more authoritative stance may be more successful. With intelligent or professional patients, an explanation of the issues involved will probably be more successful.

26

SOLUTION USE

- Consider suitability of other (and newer) care systems in the market
- Investigate solutions as possible cause of complications
- Review care regimen

97618-12S.PPT

4L497618-12

Solution Use and Patient Compliance

Frequently, contact lens wearers develop and maintain an interest in new developments in the contact lens field. Manufacturers of lens care products regularly release new products, and lens wearers are exposed to advertising claims of better, cheaper and more convenient care systems. Although practitioners usually stress the importance of using the 'prescribed' care system, they should also be aware of new care systems being released. Their suitability for some or all wearers should be assessed regularly.

Unless questioned specifically, patients are usually reluctant to inform the practitioner of changes they have initiated. An investigation of the care system should be instigated if problems arise that are apparently not lens fit-related. Patients know little about the differences between lens care products and may have used/be using solutions other than those recommended.

If a decision to use a new solution is made, the procedures to be followed should be re-taught. If there is no difference from the current system, a brief review will help reinforce compliance.

When determining compliance with the recommended care regimen, the following questions are relevant:

- How do you clean (rub and rinse) your lenses every time you take them out?
- How often do you clean your lenses (even if they are worn for extended wear)?
- How do you keep the lens case clean?
- What solutions are you using for cleaning, disinfection and rinsing?
- If protein removal is needed, is it done as frequently as recommended?
- For how long are the lenses disinfected?

27

HYGIENE

- Personal care
- Lens case and accessories
- Solution storage and use

97618-13S.PPT

4L497618-13

Hygiene

Commencement of contact lens wear often requires the adoption of an improved level of personal hygiene. Over time, patients will tend to revert to their old habits and standards of hygiene. Practitioners should remember that compliance is usually the exception rather than the rule. For this reason, regular education and re-education, although time-consuming, is a necessary part of after-care.

Good hygienic practices involve:

- Personal care.

  This is perhaps the best indicator of the probable level of personal hygiene. Usually, a clean and hygienic person also applies their

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HYGIENE
SOLUTION STORAGE AND USE

Remind wearers:

- Wash hands
- Sterilize lens case and accessories
- Replace bottle caps promptly
- Place caps face down
- Remove dribbles from sides of container
- Avoid touching bottle tips to skin, surfaces or water

97618-14S.PPT

4L497618-14

29

4L40067-92

30

4L41692-91

has a high standard of lens care and maintenance. A less hygienic person will need their behaviour modified. Generally, it is easy to distinguish between patients with good and bad hygiene.

- Contact lens case and accessories hygiene.

  A wide range of contact lens cases and accessories, made from a variety of engineering plastics, is available. Knowing the appropriate cleaning/sterilization method for a particular case or accessory is necessary but not always easy to determine. Ideally, any material that comes in contact with contact lenses should be able to withstand boiling. A soiled lens case, use of an inappropriate case and infrequent cleaning can lead to complications and ocular infections.

- Solution storage and use.

  In a study of microbial contamination of contact lens care systems (rigid and soft), Donzis *et al*. (1987) discovered that 50% were contaminated. Of commercial solutions, 13% were contaminated 21 days after opening and use by asymptomatic patients. Seven patient solutions were found to be contaminated by the pathogenic *Bacillus* species (Gram + bacteria) which can cause endophthalmitis and corneal ulceration. Most of the micro-organisms isolated were aerobic and found to be part of the normal skin/ocular flora. These findings indicate the importance of good hygiene when using solutions. Reinforcing the advice given (slide 28) will help prevent microbial contamination. Two issues of importance are:

  - Bottle caps, when unscrewed, should be placed open-face down on the table (slide 29).
  - Avoid letting bottle tips (dispensing nozzles, jets) touch the skin, other surfaces or water which may contain micro-organisms that can contaminate the solution (slide 30).

31

ADDITIONAL INSTRUCTIONS

Provide additional instructions

relevant to specific patient-related

activities

97618-15S.PPT

4L497618-15

Additional Instructions

Additional instructions on care and maintenance should be provided to patients in the following circumstances:

- Travelling.
- Playing sport.
- Taking medication.
- Convalescing and having ceased lens wear.
- Engaged in any other activity that may necessitate a change in lens care.

V Symptomatology in Contact Lens After-Care

32

SYMPTOMATOLOGY IN CONTACT LENS AFTER-CARE

After-care is

on-going care

97618-16S.PPT

4L497618-16

33

SYMPTOMATOLOGY IN CONTACT LENS AFTER-CARE

Ask *specific* questions rather than closed questions requiring just a simple YES or NO answer

97618-21S.PPT

4L497618-21

34

Name: _____ Date: ___ / ___ / ___

AFTER-CARE QUESTIONNAIRE

RIGHT / LEFT *(please circle)*	**FREQUENCY** Just Once / Intermittent / Persistent	**WHEN** Insertion / During Wear / After Removal	**SEVERITY** Mild / Moderate / Severe	**DURATION** < 1 Min / 1-10 Mins / > 10 Mins	**CAUSALITY** Normal for Patient / Environmental (e.g.Air Con) / Foreign Matter / Lens Related / Care Regimen Related / Other (please explain)
None					
Blurred Vision					
Haloes / Flare					
Photophobia					
Tearing					
Lens Awareness					
Burning / Stinging					
Dryness					
Itching					
Redness					
Unusual Eye Secretions					
Lens Needs Cleaning					
Other _____					

40034-97.PPT

4L40034-97

Symptomatology in Contact Lens After-Care

Symptomatology is the study of symptoms, their development and the indications they provide which are of assistance in identifying the disease or complication. In contact lens practice, symptomatology should not be limited to contact lens use, as conditions may arise that only become manifest as a result of lens wear, but which are not contact lens effects *per se*. The eyes are adapting continually to lenses because of minute time-dependent changes occurring in the lenses. This is why after-care is *on-going* care.

Unscheduled visits are usually emergency cases. In such cases it may be necessary to determine priorities and the course of action(s) to be taken from the moment the patient calls. If they have not already done so, it may be prudent for the patient to remove their contact lenses (if in doubt, take them out). Referral to another practitioner or an ophthalmologist may be necessary. A contingency plan for handling emergency cases should be in place in the practice for those occasions when the attending practitioner is absent or the practice is unmanned.

A systematic approach is necessary to identify correctly the cause of the symptoms so that appropriate remedial action can be taken.

The following are central to a reliable differential diagnosis:

- Description of symptoms and complaints.
- Onset of problems.
- Patient compliance with recommended care regimen.
- Associated circumstances.

Questions that practitioners and/or clinical assistants ask the patient should be as specific as possible and should encourage descriptive responses. Patient responses can be recorded on a suitable pro forma (slide 34).

Adaptive symptoms with **RGP** lenses include:

- Difficulty looking up and/or to the side.
- Abnormal head posture and interpalpebral aperture narrowing.
- Lid and eye itchiness.
- Photophobia and glare.
- Frequent blinking.
- Red eyes.
- Fluctuating vision.
- Haze and flare.

- Lid swelling.
- Spectacle blur (mild).
- Discomfort and/or mild irritation.
- Lenses and eyes feel dry especially towards the end of the wearing period.

Adaptive symptoms with **SCLs** include:

- Little, if any, adaptation.
- Vision reduced, fluctuating or hazy.
- Lenses and eyes feel dry, especially towards the end of the wearing period.
- Red eyes.
- Lenses sting on insertion.

Non-adaptive symptoms include:

- Significant discomfort.
- Dryness.
- Redness, especially if persistent.
- Vision reduction.

In some extreme cases, lens wear may have been abandoned. The reasons for this need to be investigated thoroughly. Possible reasons include:

- The need for replacement lenses.
- Care of lenses considered too much effort.
- Insertion and removal considered too much effort.
- Lenses and/or lens care products considered too expensive.
- Unwilling to tolerate adaptive symptoms.
- Unwilling to comply with issued instructions even minimally.

Adaptive and non-adaptive symptoms after Mandell (1988). These are covered more fully in Unit 4.3.

35

SYMPTOMS AND COMPLAINTS

- Reduced vision:
  - when, description, circumstances
- Discomfort:
  - where, when, description, circumstances

97618-17S.PPT

4L497618-17

Description of Symptoms and Complaints

Vision

- Is vision blurred or distorted?
- Is the visual complaint at distance or at near?
- Is the visual compliant unilateral or bilateral?
- Is the visual complaint intermittent, fluctuating or constant?
- Were R and L contact lenses interchanged?

Discomfort

- Is the discomfort a minor irritation, a dull ache, tenderness or pain?
- Is the discomfort described as gritty, dry,

stinging, warm or hot?

- Is the pain felt in or on the eye, around or in the eyelids?
- Is the discomfort intermittent, constant or occasional, with and without lenses?
- Is there an accompanying mucus discharge, tearing or crust formation. Does this occur in the morning or during the day, sometimes or all the time?
- Does the discomfort occur on or soon after lens insertion, or after a number of hours of wear?
- Does the discomfort increase over time, with lens wear or without lens wear?

36

ONSET OF PROBLEMS

- Time of day
- Description of onset
- With/without lenses

97618-18S.PPT

4L497618-18

Onset of Problems

The practitioner's task is to determine whether the cause of contact lens-related problems is due to:

- Fitting.
- Lens material.
- Wearing time.
- Wear modality.
- Lens care system.
- Lens parameters.
- A combination of the above.

The circumstances surrounding the onset of the problem may give an indication of the likely course of development:

- Does it occur upon lens insertion, early in the day or later, in the afternoon or evening?
- Is the onset sudden or gradual, and does it increase over time?
- Is the discomfort felt with or without lenses or both?

37

ASSOCIATED CIRCUMSTANCES

- Environmental changes
- Drugs and medications
- Changes to routine
- Stress

97618-19S.PPT

4L497618-19

Associated Circumstances

- Are you aware of any changes in the environments you are exposed to (especially gas or chemical fumes) which occurred at about the time you began experiencing discomfort?
- What drugs or medication have you taken lately?
- What changes have there been to your everyday routine, habits and lifestyle?
- Can you describe any stress-related activities, if any, at work, home or within your family?

38

COMPLIANCE

Non-compliance is probably the biggest source of contact lens-related problems

Compliance levels range from:

26% (Collins & Carney, 1986)

to

60% (Chun & Weissman, 1987)

97618-20S.PPT

4L497618-20

Compliance

Non-compliance is probably the biggest source of contact lens-related problems. Despite the best efforts of practitioners, the compliance level (adherence to instructions issued) of many contact lens wearers leaves much to be desired. Many studies have shown compliance levels between 26% (Collins and Carney, 1986A) and 60% (Chun and Weissman, 1987). The contact lens industry responds to needs and has produced products which, when used correctly, can generally be expected to result in trouble-free contact lens wear. If products are misused, or not used at all, their performance can be expected to be suboptimal and the complication rate for contact lens wear will be higher. This has already been shown by Collins and Carney (1986B).

VI Success Criteria for Soft and Rigid Lens Wear

39

SUCCESS CRITERIA

FOR

CONTACT LENS WEAR

97731-1S.PPT

4L297731-1

Success Criteria for Soft and Rigid Lens Wear

This section presents criteria for DW and EW lens wear success based largely on the standards of the CCLRU (Cornea and Contact Lens Research Unit, School of Optometry, The University of New South Wales). These in turn are an update/revision of the success standards outlined by Sarver and Harris in 1971 (Terry *et al*., 1993).

Successful daily wear is a prerequisite of the commencement of an extended wear schedule.

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SUCCESS CRITERIA FOR CONTACT LENS WEAR

WEARING TIME

DW

- 12 hr/day for 5 days or more/week

EW

- 6 or more consecutive nights before an overnight removal

97731-2S.PPT

4L297731-2

41

SUCCESS CRITERIA FOR CONTACT LENS WEAR

COMFORT

- Soft lenses should be comfortable immediately after insertion and remain substantially so for the wearing period.
- RGP lenses, while initially not as comfortable, should be comfortable by 1 month.

97731-3S.PPT

4L297731-3

Comfort

Wearer comfort is probably the most important criterion for success. Lenses should not cause irritation or discomfort and any discomfort should be alleviated promptly by simple measures.

SCL patients must report the lens being comfortable immediately after insertion. RGP lenses, which usually offer less initial comfort, may require up to one month of adaptation before providing the same level of comfort as SCL lenses.

42

SUCCESS CRITERIA FOR CONTACT LENS WEAR

VISION

Equal to, or better than, habitual spectacle visual acuity.

97731-4S.PPT

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Vision

Visual acuity with CLs should be equal to, or better than, the habitual spectacle acuity on both low and high contrast charts.

Contact lenses should not produce any significant blur, fluctuations in vision, haloes, or flare.

43

SUCCESS CRITERIA FOR CONTACT LENS WEAR
EW OCULAR TISSUE CHANGES

Hypoxia:

Microcysts:	≤ 10
Vacuoles:	≤ 10
Striae:	1 (< 1 hr)
Folds:	None

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Ocular Tissue Changes

Hypoxia

Overnight corneal oedema, and the resultant corneal swelling, are the best indicators of EW hypoxic stress. Hypoxia is also implicated in the development of microcysts, vacuoles, striae and folds. These signs should not normally be present in DW.

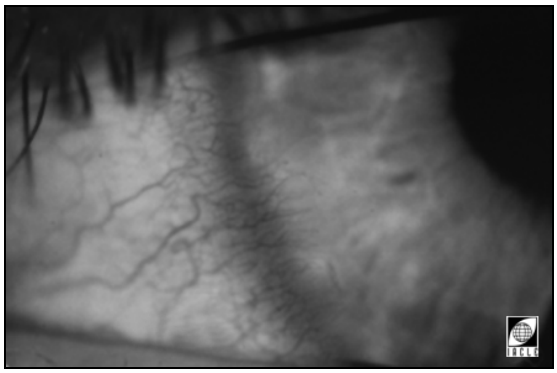
Microcysts and vacuoles can occur over time with both wear modalities and should not exceed 10 for either mode.

Stromal striae indicate a corneal swelling of 5% or more, while folds indicate 8% or more. Overnight corneal oedema occurs with EW but should be followed by rapid deswelling (thinning). Striae seen one hour after eye opening is indicative of overnight corneal swelling of 5 to 6%.

When overnight corneal oedema is high or deswelling is slow, appropriate action should be taken to provide increased corneal oxygenation by changing one or more of the following:

- Lens material.
- Lens design.
- Wearing schedule.

44



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Ocular Tissue Changes

Corneal Vascularization

New vessel growth into the cornea is indicative of corneal stress and a shortage of metabolic nutrients, especially oxygen. Limbal vessel growth is observed more amongst wearers of thick, low water hydrogel lenses than RGPs or thin hydrogel lenses.

New vessel growth should not exceed 0.5 mm beyond the corneo-limbal transition zone in any part of the corneal circumference.

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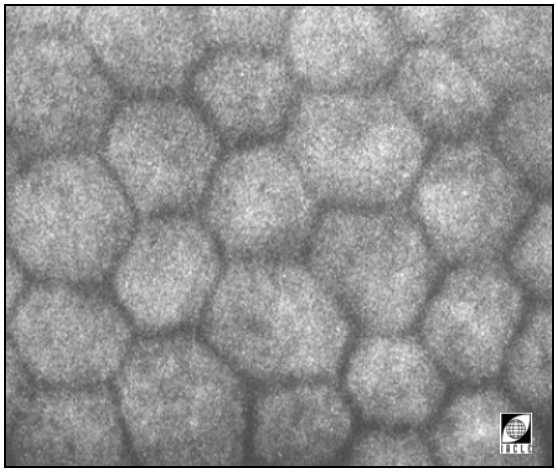

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Ocular Tissue Changes

Endothelial Polymegethism

The degree of polymegethism can be graded with a slit-lamp and an increase due to contact lens wear of greater than one grade is unacceptable.

46

SUCCESS CRITERIA FOR CONTACT LENS WEAR
MINUMUM CORNEAL CURVATURE CHANGE

Horizontal: ≤ 0.50 D

Vertical: ≤ 0.75 D

97731-6S.PPT

4L297731-6

Corneal Curvature and Refractive Error Changes

Corneal curvature changes in the principal meridians should not exceed 0.50 D (horizontal) and 0.75 D (vertical). They may be induced by mechanical molding or corneal oedema especially in the vertical meridian and may result in reduced corneal toricity.

Low Dk/*t* lenses can cause corneal distortion and warpage which indicate the need to change the lenses to ones of a more suitable material or design.

47

SUCCESS CRITERIA FOR CONTACT LENS WEAR
ACCEPTABLE STAINING GRADES

Type: ≤ 2

Depth: ≤ 1

Extent: Little of the cornea involved

97731-7S.PPT

4L297731-7

Corneal Staining with Fluorescein

Corneal staining occurs when there is epithelial cell damage or loss allowing instilled fluorescein to penetrate the cells or the space that was occupied by the lost cells. Cell loss or damage can lead to localized stromal oedema and increased risk of infection. If the damage is severe enough, sub-epithelial spreading of fluorescein can produce a diffuse 'halo' as a backdrop to the better defined area of damage.

Using the following scale, persistent staining of the cornea should not be more than grade 2 for type and grade 1 for depth:

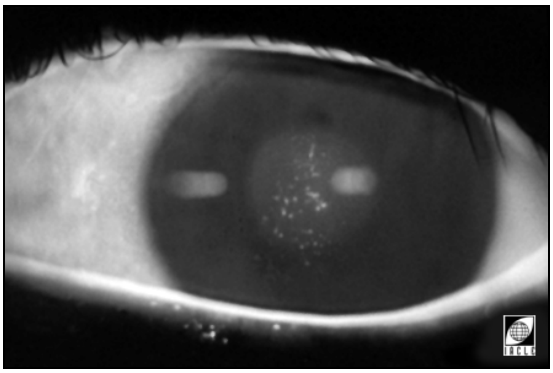
Type

0 Absent
1 Micropunctate
2 Macropunctate (slide 48)
3 Coalescent macropunctate
4 Patch

Depth

0 Absent
1 Superficial epithelial involvement (slide 49)
2 Stromal glow present within 30 seconds
3 Immediate localized glow
4 Immediate diffuse stromal glow

48



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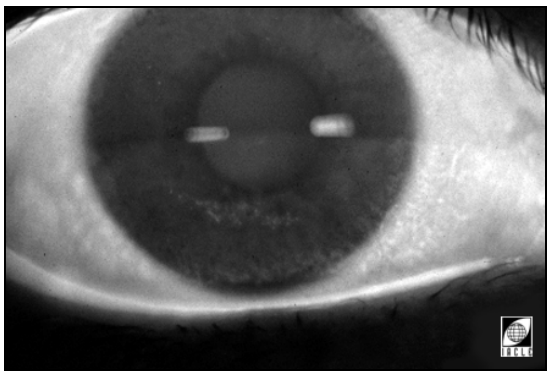

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Extent

It is difficult to estimate accurately the area of the cornea stained with fluorescein. Perhaps a nil, mild, moderate and severe grading system is appropriate. Even moderate involvement should be regarded as undesirable and steps taken immediately to prevent any continuation or reoccurrence of the staining.

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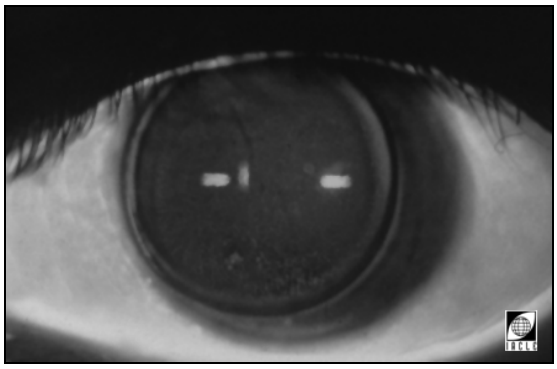

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Lens Adherence

As discussed previously, lens adherence is common among EW RGP wearers. Persistent adherence can trap debris under the lens and provoke an inflammatory acute red eye reaction.

This slide shows the characteristic pooling of fluorescein around the circumferential area of compression after removal of the lens.

Lens adherence should not be observed among DW patients and should not occur persistently with EW.

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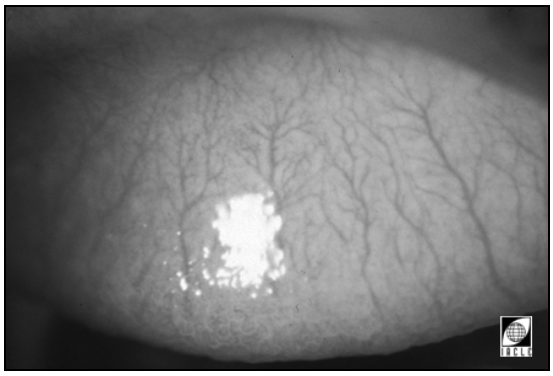

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Contact Lens-Induced Papillary Conjunctivitis

Persistent CLPC may develop into GPC and cause significant patient discomfort resulting in discontinuation of wear. The upper and lower lids must be everted and examined for roughness and redness of the palpebral conjunctiva. Grading is based on a 0 (absent) to 4 (severe) scale.

There should not be more than a one grade increase in papillae.

52

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Patient Appearance

There should not be a significant change in the overall appearance of the patient. Changes resulting from contact lens wear such as excessive redness of the bulbar conjunctiva, limbus, lid margins, excessive mucus formation, increased blink rate, ptosis, or narrowing of the palpebral aperture should not be more than a one grade increase. Blink rate and palpebral aperture are more likely to be altered in the case of RGP lens wearers.

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Unit 4.5

(7 Hours)

Lecture 4.5: Slit-Lamp Examination of the Contact Lens Patient

Practical 4.5: Slit-Lamp Examination for Contact Lens Evaluation and After-Care

Tutorial 4.5: Slit-Lamp Examination of Contact Lens Conditions

Course Overview

Lecture 4.5: Slit-Lamp Examination of the Contact Lens Patient

I. Slit-lamp Examination Flowchart

II. Key Observations

III. Features and Accessories

IV. Special Slit-lamp Techniques

Practical 4.5: Slit-Lamp Examination for Contact Lens Evaluation and After-Care

Tutorial 4.5: Slit-Lamp Examination of Contact Lens Conditions

Lecture 4.5

(2 Hours)

Slit-Lamp Examination of the Contact Lens Patient

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III Slit-Lamp Features and Accessories **139**

IV Special Slit-Lamp Examination Techniques **143**

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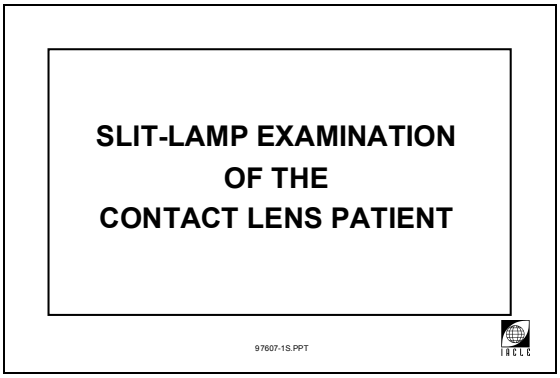
IV.B Slit-Lamp Photography and Videography 143
IV.C Pachometry 146

I Introduction

1



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Slit-Lamp Examination of the Contact Lens Patient

The slit-lamp biomicroscope has become an indispensable tool for examination of the anterior eye. This is especially so in contact lens practice, where it has applications in almost every phase of contact lens patient management. These range from routine ocular and contact lens examinations to detailed investigations of special conditions.

The slit-lamp also can be equipped with accessories to enable comprehensive video and photographic documentation of eye and lens conditions from the pre-lens wear stage through to the most recent after-care. The photographic recording of 'before' and 'after' images of contact lens phenomena is invaluable in contact lens practice.

While Unit 1.4 discussed routine illumination techniques and use of the slit-lamp, this lecture highlights the aspects of slit-lamp examination specific to contact lens wear. Techniques for detailed examination of specific aspects of contact lens wear are also discussed.

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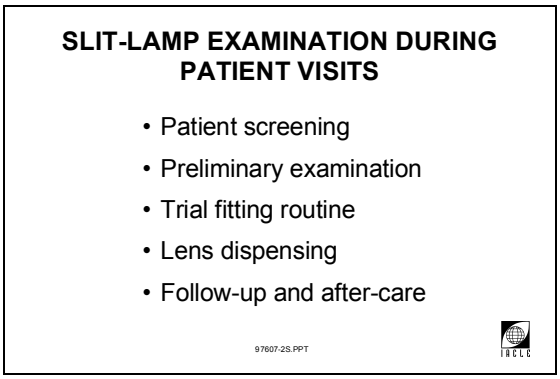

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Slit-Lamp Examination During Patient Visits

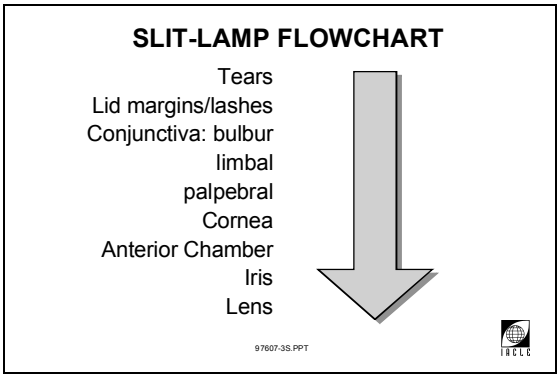
Usually, a slit-lamp examination of the contact lens patient is performed at every visit. Specific attention is paid to an assessment of lens effects on the anterior eye and the condition of the lenses themselves. An introduction to this subject is presented in Unit 3.1.

Phases of the management of a contact lens patient in which a slit-lamp examination is central include:

- Patient screening:
  - patient selection
  - baseline measurements.
- Preliminary examination:
  - determining specific ocular indications/contraindications
  - assessing ocular integrity and characteristics relevant to contact lens wear.
- Trial fitting.
- Lens dispensing.
- Follow-up and after-care.

Competent examinations and appropriate record keeping allow comparisons to be made between the state of the eyes before and after contact lens wear. The information derived helps to determine what changes, if any, need to be made to the lenses, wear schedule or even the replacement

3



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schedule.

A flowchart of the structures to be observed routinely is presented in slide 3. Its sequence results in a systematic examination which starts from the outermost structure and progresses to the innermost.

The crystalline lens, anterior chamber and iris may be excluded from the routine slit-lamp examination after the preliminary visit unless inflammation of the eye is suspected. However, they should be included in the annual general eye examination in order to detect any sign of pathology from other causes.

4

TIPS FOR PATIENT COMFORT DURING SLIT-LAMP EXAMINATION

- Clear instructions/explanations
- Instrument-patient-examiner alignment
- Proficient and skilful slit-lamp usage

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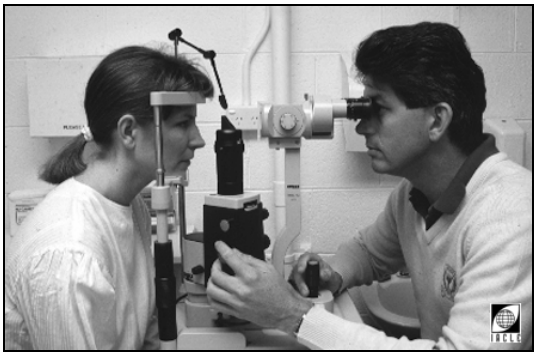

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Tips for Patient Comfort During Slit-lamp Examination

Since the slit-lamp examination occupies the bulk of each visit, it is prudent to ensure patient and practitioner comfort before commencement and that the patient is relaxed. The following guidelines help to achieve this:

- Firstly, explain the purposes and importance of a slit-lamp examination.
- Proper patient posture prevents strain on the spinal column and should therefore, guarantee cooperation, especially with children and the elderly. This can be achieved by adjusting the height of the patient's seat so that they are able to sit upright.
- The patient's head (and either chair height or instrument height) should be positioned such that the chin is comfortable in the chin rest and the forehead is resting gently against the head rest.
- The instrument height should be set such that either the chin rest or the head rest can be adjusted during the examination. The marker on the chin rest supports should be aligned with the patient's outer canthus (slide 5).
- The practitioner should also be comfortable. A chair/stool with adjustable height is essential and the light controls (room and instruments) should be within easy reach.
- During the examination, the patient should be given clear instructions such as looking at the fixation target, different positions of gaze, letting their teeth come together lightly, etc. A systematic approach should be followed that is time efficient and does not cause patient fatigue.
- Explain techniques where it may help the patient to relax. Examples are lid eversion and fluorescein instillation.
- The slit-lamp should be used with care. Careless swinging of the illumination system usually creates the impression of clumsiness or even inappropriate flamboyance. Patient comfort should be considered when adjusting instrument light levels since many instruments are capable of producing mild photophobia due to excessive illumination.

Following the examination, re-assurance should be given to the patient concerning its findings.

II Key Observations During a Slit-Lamp Examination

6

SLIT-LAMP EXAMINATION
KEY OBSERVATIONS

- Lids and conjunctiva
- Cornea and limbus
- Tears

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Key Observations During a Slit-lamp Examination

During a slit-lamp examination, observation of the following, both with and without contact lenses, indicates sound ocular health and safe contact lens wear:

- Lids and conjunctiva (see a division of the areas of the upper lid in slide 7).
  - absence of inflammation
  - normal redness
  - normal anatomy
  - smooth surface texture.
- Cornea and limbus (see a division of the areas of the cornea in slide 8).
  - absence of redness
  - absence of vascularization
  - absence of any tissue changes
  - transparent/translucent appearance
  - absence of signs of oedema
  - normal endothelial mosaic
  - normal structure.
- Tears.
  - apparently normal viscosity and movement
  - absence of excessive tear film debris
  - stability and normal break-up time of the tear film
  - normal tear volume (tear prism height)
  - normal appearance of lipid layer.

The number of anterior eye features that can be assessed in a practical time period usually depends on the skill of the practitioner. For practitioners with little experience who assess one feature at a time, the process can be time consuming.

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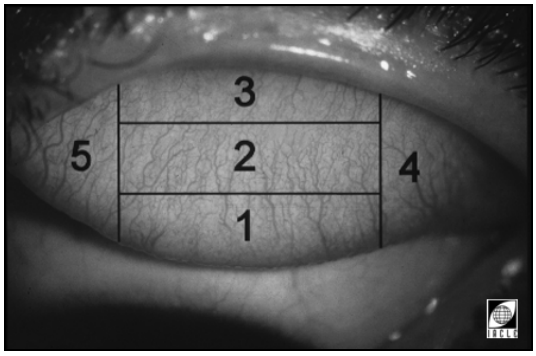

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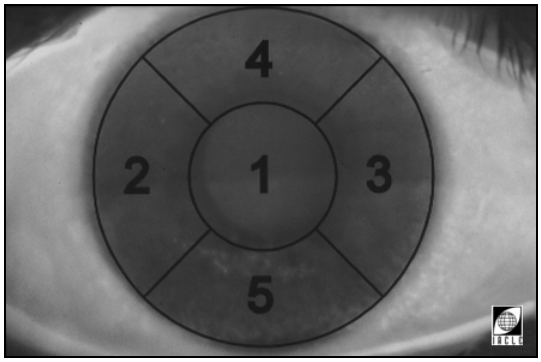

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9

SLIT-LAMP EXAMINATION
KEY OBSERVATIONS

- Dynamic fitting assessment
- Static fitting assessment
- Lens location behaviour
- Lens condition and wettability
- Obvious lens features

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Key Observations During a Slit-lamp Examination

Aspects of lens fit which can be assessed during a slit-lamp examination include:

- Dynamic fitting assessment.

The lens movement resulting from a blink and versions is of interest. Also of interest is the lens behaviour with the eye in the downgaze position. The edge of the lens should not locate over the limbus at any time with the eye in any reasonable position for both RGP and SCL lenses.

- Static fitting assessment (RGP lenses).

  Lens fit and behaviour should also be observed:

  - with the eye stationary and both lids retracted. This eliminates the influence of lid factors (tonus, position and movement) and eye movement.
  - with the eye stationary without the lids retracted, i.e. in static mode to determine the normal lens position.

- Locational behaviour of the lens in relation to the position of the lids.

  Lens behaviour varies with the individual's lid characteristics. Design is also a key factor in determining the *in situ* behaviour of a lens.

- Lens condition and wettability.

  Lens surface wettability is affected by many factors. Contamination during handling, especially after using make-up, creams, lotions and soaps, can cause dry spots or non-wettable areas.

- Obvious lens features (toric reference marks, bifocal segments, company logos, lens identification marks, etc.)

  Because contact lenses are transparent (or essentially so), the lens features present in special lenses are often difficult to assess. While some are obvious, e.g. opaque tints, implanted bifocal segment, most are not. Often only the lens position relative to the the pupil can be assessed. This can only be done with a slit-lamp, and some finesse is required.

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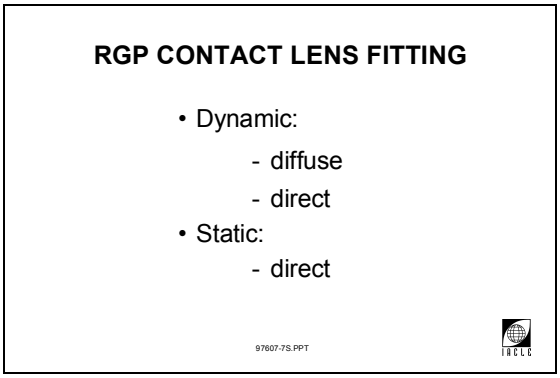

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RGP Contact Lens Fitting

Slit-lamp techniques used to assess the fitting of RGP contact lenses include white light and cobalt blue illumination for both static and dynamic fitting assessment. The following illumination techniques are the most useful for assessing RGP lens fit:

- **Dynamic Fitting**

  Diffuse illumination at medium magnification is used to check lens movement and centration. Measurements can be made with an eyepiece graticule. This illumination method, at higher magnification (30 - 40X), can be used to examine the pre-lens tear film, the lipid layer, and lens wettability. A Tearscope™ can also be employed for this purpose.

  Direct illumination with a narrow slit beam (optic section) is used to observe the post-lens tear film and tear lens. By using a narrow slit, focused centrally and traversing the central pupillary area, the tear lens thickness can be observed (slide 12, the arc to the left is the slit beam. the arc to the right is a rigid lens edge). However, in SCLs the tear lens is practically non-existent. The use of fluorescein dye can

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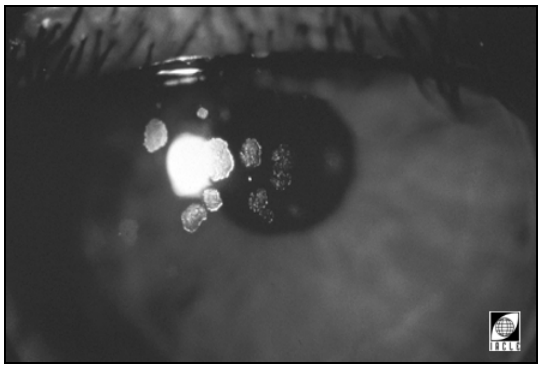

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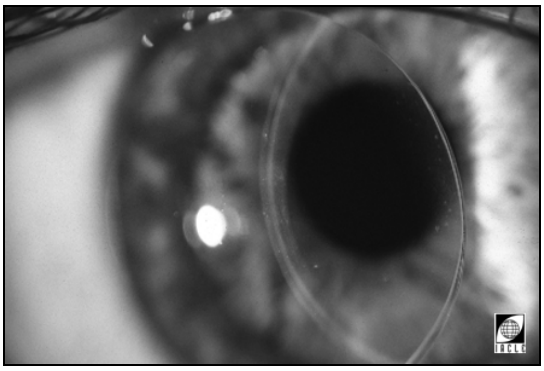

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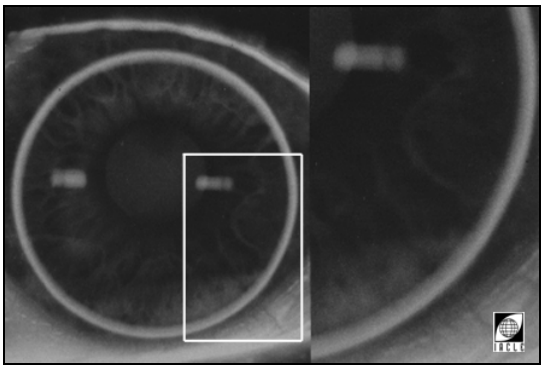

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enhance the appearance of the tear lens in RGP lenses.

- **Static Fitting**

RGP lens static fit is observed primarily to assess the lens-cornea relationship. After sodium fluorescein is instilled in the tears, cobalt blue light and a Wratten #12 yellow barrier filter (or equivalent) are used to assess the fit qualitatively at low magnification.

Direct illumination with the slit aperture opened fully can cause glare and discomfort. Engaging the cobalt blue filter feature before fully opening the slit aperture helps avoid glare and discomfort.

To observe the overall fitting pattern at low magnification, the RGP lens should be centred by manipulating the lids as necessary. Except while centring the lens, the lids should be retracted so they have no influence on lens fit. However, this is akin to determining the 'theoretical' lens fit. The 'real' lens fit can only be determined while the lids are affecting the lens and therefore, the fitting pattern.

The width of edge clearance can be measured using an eyepiece graticule at low to moderate magnification. Variations in edge width around the lens may be observed. However the results with the lens centred on the eye are a more useful measure.

Edge clearance itself can be estimated. At high magnification with the lens centred, the tear meniscus width at the nasal and temporal edges is observed. No quantitative measure is possible in general clinical practice. An average theoretical edge clearance is 70 - 80 μm.

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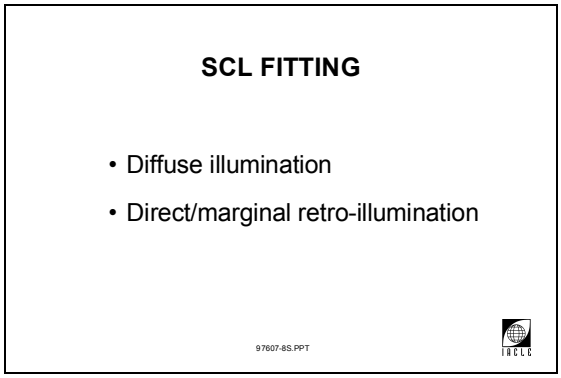

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SCL Fitting

SCL fitting is usually assessed with the slit-lamp under white light illumination. The desired fitting characteristics are presented in more detail in Unit 3.2.

Diffuse illumination can be used to assess lens centration, movement and tightness.

Centration and movement are assessed at low to moderate magnification. Movement should comply with the manufacturer's recommendations. An eyepiece graticule may be used to measure the amount of lag in primary gaze.

Tightness is best examined by the lower lid push-up test.

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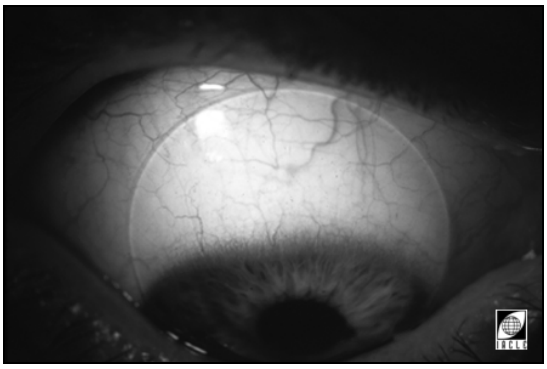

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In addition, the following can usually be observed concurrently:

- Lens contamination.
- Lens surface wettability and tear film lipid layer.
- Front and back lens surface debris.

Higher magnification is required for observation of the tear film and surface contamination.

Direct retro and marginal retro-illumination are useful techniques for observing mucus and other forms of lens surface contamination.

Using a medium to wide beam and high magnification, contamination can be seen contrasted against the out-of-focus iris behaving as a retro-reflector.

Non-adherent matter can be seen moving over the lens surface and drifting in the tear film. Adherent contaminants are seen as stationary foreign bodies or films which move in harmony with the lens.

17

SCALES FOR SLIT-LAMP EXAMINATION

- Measurement scales
  - nominal
  - ordinal
  - interval
  - ratio
- Grading scales

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Measurement and Grading Scales for Slit-Lamp Examination

A thorough, competent and professional slit-lamp routine should be a systematic performance with smooth transitions from one technique to the next. Often, concurrent observations can be made because the techniques or the area under observation, overlap. Proficiency at observation and rating/recording is developed with experience.

Measuring and rating:
There are four types of 'measurement scales' in common use; *nominal, ordinal, interval* and *ratio* scales. *Measurement* is defined as the assignation of numbers to objects, events, observations, etc. according to a set of rules established before the measuring process is begun.

- *Nominal:* This is the weakest type of measurement. Objects are sorted by type or name. Examples include eye diseases, types of microscopes and brands of cars.

  It is impossible to compare nominal data quantitatively. For example, it is impossible to say that Fuch's Dystrophy is *better* than Posterior Polymorphous Dystrophy even though both are endothelial dystrophies. However, it is possible to apply the chi-square test to such data when testing the frequency of occurrence (between two populations for example).

- *Ordinal:* An ordinal scale involves the assignation of rank. Thus claims of higher, greater, better etc. can be made. More usefully, statements such as *greater than*, *less than* or *equal to* can be made and weak quantitative analysis is possible.

  An example of an ordinal measurement is van Herick's Test (or van Herick, Schaffer, Shwartz) for estimations of the depth of the anterior angle where the apparent angle 'depth' is compared with one quarter of the corneal thickness in the same slit section, i.e. apparent angle depth is > ¼ CT, =¼CT, <¼CT. Quantitative comparisons are possible and numerous non-parametric statistical tests can be applied to such data.

- *Interval* (sometimes *equal-interval or cardinal*)*:* The use of an interval scale assumes an exact knowledge of the quantitative differences between the 'objects' being scaled, i.e. it must be possible to assign a number to each 'object' in such a way that the relative difference between 'objects' is accurately reflected in the numerical difference. A one-unit difference between any two 'objects' must indicate the same difference between any other pair of objects also rated as being one-unit different. The choice of the zero point can be made arbitarily.

  An example of an interval scale is the Centigrade temperature scale. The scale has uniform intervals with zero arbitarily set as the freezing point of pure water under 'normal' conditions. Yet it cannot be claimed that the cornea at 34°C is twice as 'hot' as the room at 17°C. In fact, when converted to a rigorous absolute scale like Kelvin, such temperatures (307K & 290K) are not related by anything like 'twice'. While the Centigrade temperature scale has 'units', interval scales can also be dimensionless, i.e. simple numbers such as 1, 2, 3, 4, etc. Statistical tests such as the *t* test and the *F* test can be applied to interval scales. Such scales are common in contact lens practice.

- *Ratio:* This is the strongest type of measurement. It has all the properties of an interval scale as well as a natural origin or zero point.

  The Kelvin temperature scale is an example of a ratio scale. Other examples include thickness, length, mass, etc.

  The setting of a natural zero (the cessation of all molecular activity in the case of the Kelvin temperature scale) allows not only the direct comparison of intervals but also the comparison of their absolute values as well. Virtually any statistical test can be applied to ratio scales.

  The foregoing is after Harnett, 1975.

The scales used in contact lens theory and practice are usually either equal interval or ratio scales.

Grading scales are standardized measures based on photographic or schematic representations of conditions. Charts that have been made available for practitioners include:

- CCLRU Grading Scales (CCLRU, 1997)
- Efron Grading Scales for Contact Lens Complications (Efron and Tarrant, 1997)

These charts are useful in standardizing assessments in practice.

18

KEY SLIT-LAMP OBSERVATIONS
FOLLOW-UP AND AFTER-CARE

- Changes to lens fitting
- Signs of any adverse response

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Key Slit-Lamp Observations During the Follow-Up and After-Care Visits

Follow-up and after-care visits are among the most important aspects of patient management. During these visits, a slit-lamp examination is performed primarily to determine if wearing contact lenses has resulted in any adverse effects. To accomplish this, a number of aspects need to be investigated. These include:

- Changes to lens fit.

  During the adaptation period, the eye may change to accommodate the sustained presence of a contact lens. After initial adaptation, decreases are seen in excessive lacrimation, corneal sensitivity and lens awareness.

  These adaptive changes can also result in an altered lens fit, e.g. a tightening of fit and/or decreased lens movement. A comparison between after-care and baseline data will confirm or refute any impression of significant changes to lens fit and vision quality.

- Ocular signs of adverse changes during adaptation to contact lenses.

  The ocular adnexa should be examined for changes that are not adaptations:

  – increased corneal and conjunctival vascularization and redness
  – excessive corneal and conjunctival staining
  – unstable tear film and/or abnormal (short) break-up-times
  – abnormal discharges.

III Slit-Lamp Features and Accessories

19

SLIT-LAMP FEATURES AND ACCESSORIES

- Illumination system controls
- Light filters
- Vital stains

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20

SLIT-LAMP FEATURES AND ACCESSORIES

ILLUMINATION SYSTEM

- Rotatable slit
- Beam offset
- Multiple slits

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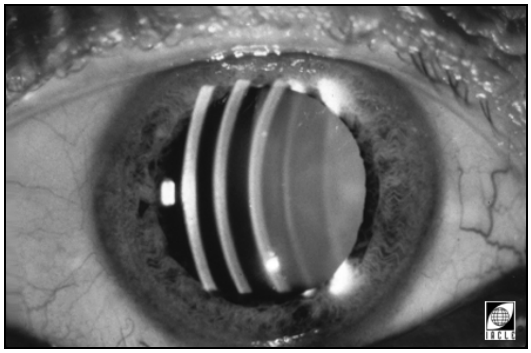

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Illumination

To assist the observation of less conspicuous structures and subtle conditions, the illumination system of the slit-lamp has several features that can modify the emitted light. These features, when used in conjunction with suitable vital stains, result in improved rates of detection and/or better quality observations. These features include:

- Rotatable illumination system (whole system or the slit control module on some instruments) that provides an oblique beam of light. This is useful for conditions with amorphous shapes or areas of interest located in the superior and inferior corneal periphery. Measuring toric lens axis mislocation is also more accurate with appropriate slit rotation.
- Illumination system offset. The direction of the slit beam can be offset so that the field of illumination no longer coincides with the field of view of the microscope. This allows indirect illumination techniques to be used. Such techniques are particularly well suited to showing refractile properties of any changes induced by lens wear.
- Advances in slit-lamp design include:
  - Multiple slits giving several optic sections of the cornea simultaneously. A result from a Zeiss SL 130 slit-lamp with triple slits is depicted in slide 21.
  - Teaching eyepieces.
  - Video and photographic attachments.
  - Internal flashes in which the flash tube and lamp filament are in conjugate planes and contextural light sources are derived from the main light (and therefore flash).

22

SLIT-LAMP FEATURES AND ACCESSORIES

FILTERS

- Yellow barrier filter
- Red-free (green) filter
- Neutral density filter
- Cobalt blue filter
- Diffuser

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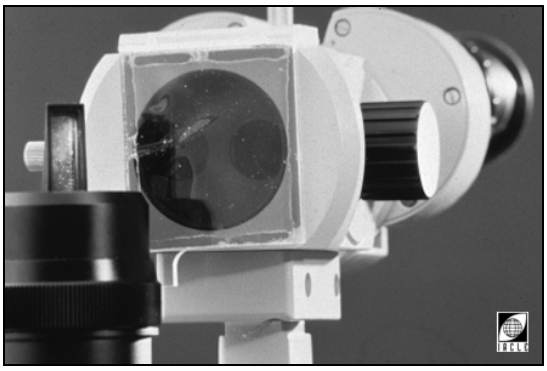
Filters

- The **Kodak Wratten #12 yellow barrier filter** or its equivalent is used to eliminate unfluoresced blue light from the slit-lamp view during a fluorescein-assisted investigation of the cornea. It is essential in cases of very subtle staining of the cornea or conjunctiva.

  These filters, some of which are gelatin-based and hence easily damaged by fingerprints and moisture), are mounted in front of, over or on the observation system. A glass equivalent is also available (e.g. Schott Glass of Germany). Yellow barrier filters are always used in combination with a cobalt blue exciter filter in or over the illumination system (most slit-lamps

23



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now have one as standard). The failure of many manufacturers to include the complementary barrier filter in their slit-lamps is seen as illogical by many users.

- **Red-free filter** (green) is used when examining the vascular architecture of, and haemorrhages in, the conjunctiva, limbus or retina. By rendering the vessels/blood as black, it allows the vessels/haemorrhages to be contrasted against the lighter background. It can be used in conjunction with the Hruby or other suitable lenses to examine the retinal blood vessels

  This green filter is built into the illumination system of some slit-lamps.

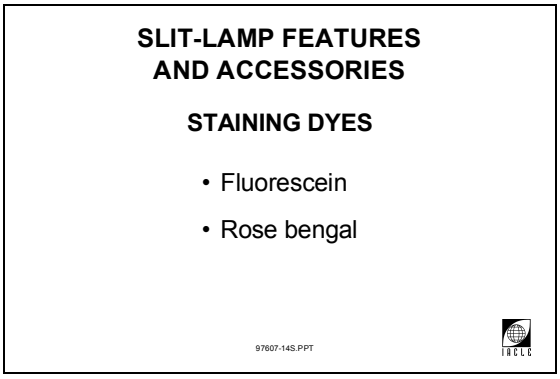
- **Neutral density filter** is a filter which is not wavelength-selective, i.e. it transmits all wavelengths of light equally. It can be used to decrease the intensity of the illumination system without altering the spectral characteristics of the light emitted. It is used to reduce light levels below that achievable with the intensity control of the slit-lamp set to minimum.

- **Cobalt blue filter** is usually present in the illumination system of most slit-lamps. It transmits the blue end of the spectrum maximally. Alterations to the structures of the anterior eye result in them imbibing fluorescein. When irradiated by blue and near-UV light, the imbibed fluorescein fluoresces in the green-yellow region of the visible spectrum. The excess blue light can behave as a veiling glare source necessitating the use of a yellow barrier filter (see above).

- The **diffuser** disperses (spreads and broadens) the collimated light emanating from the illumination system and 'softens' the light falling on the eye (by increasing the apparent size of the light source). Once diffused it can no longer be considered 'focused'.

  Diffusers are usually a removable or hinged translucent plastic accessory attached to the prism head. Other designs have the diffuser built into the illumination system within the slit module.

24



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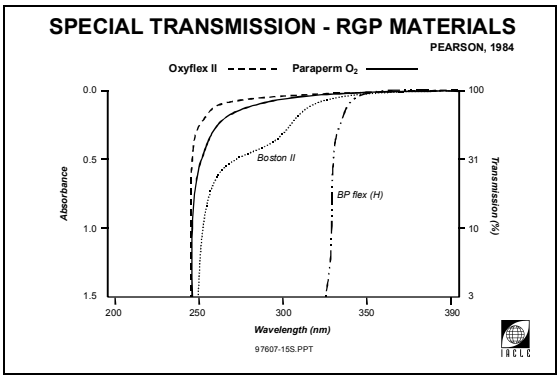
Staining Dyes: Fluorescein

Sodium fluorescein ($C_{20}H_{10}O_5Na_2$), also known as uranin, was first used by Pfluger in 1882 and Straub in 1888 for detecting epithelial defects (Pearson, 1984).

Instilled fluorescein penetrates abraded tissue and can form a halo around epithelial defects by penetrating the deeper layers of the epithelium, the subepithelial space or even the anterior stroma. Generally, any break in a cell membrane results in diffusion of fluorescein dye into the cell. Contrary to earlier studies (Norn, 1964) recent work indicates that fluorescein can penetrate intact cells (Wilson *et al.,* 1995).

Diluted sodium fluorescein is instilled into the eye and observed using light that emits ultraviolet (UV-A) and/or blue light (near UV). Fluorescein

25



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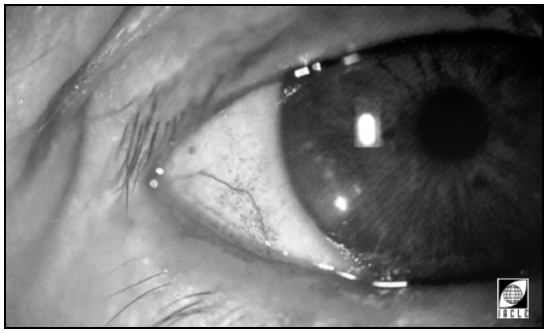
absorbs wavelengths between 485 - 500 nm and re-emits green-yellow light at 525 - 530 nm. Cobalt blue filters in slit-lamps transmit maximally from 390 - 410 nm (Pearson, 1984).

Greater contrast is achieved by using a yellow filter (Kodak Wratten #12 or 15 or equivalent) which does not transmit the shorter (blue) wavelengths, thereby eliminating the cobalt blue light from the field of view. The following slit-lamps have provision for the addition of a yellow barrier filter to the observation system:

- Carl Zeiss (Oberkochen).
- Haag-Streit 900.
- Rodenstock RO 1000.

Some RGP lens materials incorporate UV absorbers which affect the fluorescein pattern observed. Burton lamps are unsuitable for use with such materials. However, usually the cobalt blue feature on a slit-lamp will be found satisfactory. Slide 25 shows the transmission characteristics of the RGP lens materials used in Pearson's study.

26



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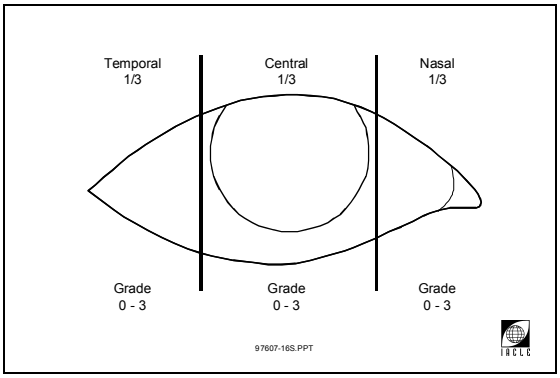
Staining Dyes: Rose Bengal

Rose bengal is a derivative of fluorescein (Hopkins, 1988). It is purplish red in colour and stains dead cells and mucus (slide 26).Recent work (Feenstra and Tseud, 1992B) has shown that is also stains epithelial cells poorly protected, or unprotected by the preocular tear film. Rose bengal also stains the skin of the lids and face.

Rose Bengal has been used as a diagnostic tool in keratoconjuctivitis sicca and dermal conditions that may play a role in affecting ocular tissue. It should be used sparingly because it is now known to be cytotoxic (Feenstra and Tseng, 1992A & B). It is available in 1% solution and causes some stinging when instilled into the eye. More details of the characteristics of rose bengal are presented in Unit 4.1.

27



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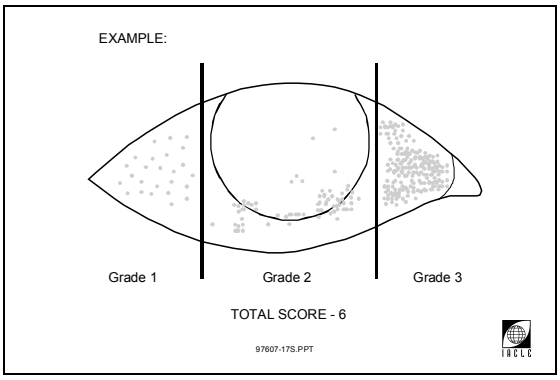
A grading system proposed by Snyder (1995, personal correspondence) is presented in slides 27 and 28 where the temporal, central and nasal regions are rated on a grade of one to three and the sum total calculated (0 - 9).

28



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IV Special Slit-Lamp Examination Techniques

IV.A Dark-Field Examination

29

SPECIAL SLIT-LAMP EXAMINATION TECHNIQUES

- Dark-field examination
- Photography and videography
- Pachometry

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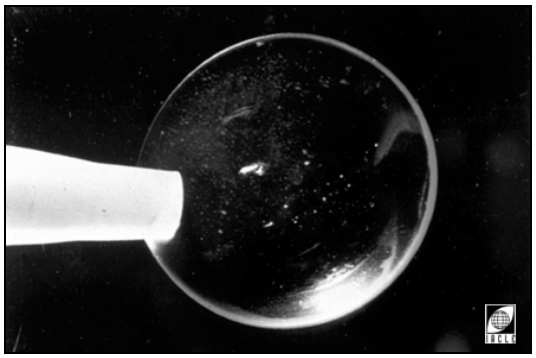
Dark-Field Examination

The slit-lamp can be used as a microscope in examining contact lenses for defects, contamination and deposits. It can also be used to identify lenses by locating logos, markers, serial numbers or other obvious features.

Lenses can be held (slide 30) or mounted in front of the instrument at about the normal viewing distance. A black non-reflective uniform background is required as a backdrop. Against this backdrop, any entity which reflects light is seen as white or 'bright' in stark contrast to the black (dark field) background.

Medium to high magnification should be used with either a wide beam or diffused illumination.

30



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The lens must be cleaned before the inspection and rinsed well with a non-aerosol saline. Aerosol salines are unsuitable because their propellant (commonly nitrogen) forms a suspension of fine gas bubbles in the expelled saline. The bubbles appear as highly reflective objects camouflaging subjects of possible interest and confusing the observer. Failure to clean the lens will, like aerosol saline propellant bubbles, make it difficult to differentiate introduced foreign matter from objects, of real interest.

After cleaning, the lens should only be handled with tweezers, as fingers will leave debris on the surfaces.

IV.B Slit-Lamp Photography and Videography

31

SLIT-LAMP PHOTOGRAPHY

- Dedicated photo slit-lamps
- Non-dedicated photo slit-lamps

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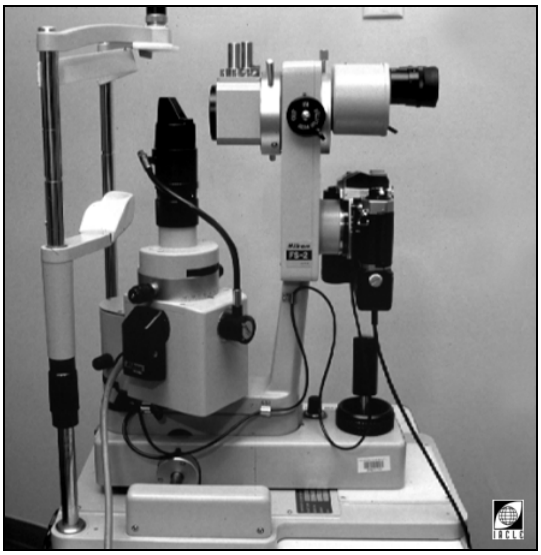
Slit-Lamp Photography

Photographic and videographic recording of slit-lamp observations offer advantages which far outweigh the cost of the equipment required. Roles include:

- Providing a clinical record which is unequivocal, concise and graphic evidence of any observations made.
- Supplying a clear and presentable record of findings for use in explanations to patients.
- Monitoring changes resulting from, and occuring during, contact lens wear.
- Recording the appearance of the eye(s) pre- and post-surgery, contact lens wear, etc. The recording may be on film, videotape or digital media.

Dedicated photo slit-lamps (slide 32) have the photographic optics, camera and flash unit incorporated into the design of the instrument. The inclusion of the flash tube within the optics of the illumination system is central to a definition of a

32



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true photo slit-lamp. It enables the incandescent globe and flash tube to be located in conjugate planes.

The position of any specular reflex observed through the microscope will also mirror the location of the specular reflex that appears in any photograph taken with flash illumination.

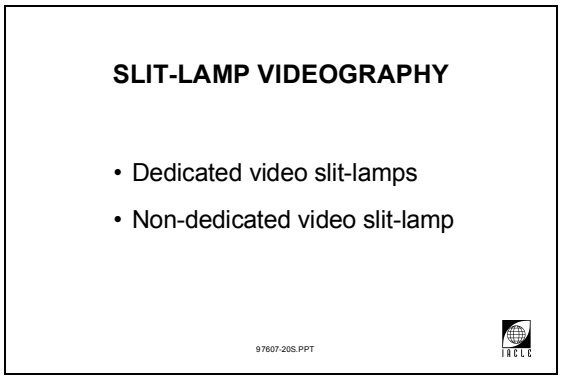
Flash intensity must also be controllable as the levels required depend on magnification, the illumination technique used and sometimes, the reflectance of the structure being recorded.

Other considerations are:

- Film 'speed', or its ISO/ASA/DIN rating, is an indication of the sensitivity of the film emulsion. Low 'speed' film requires more light for correct exposure while high speed film requires less.
- A colour film's category is a classification of its spectral recording characteristics. Traditionally the classifications are 'daylight' and 'tungsten'. 'Infra red' film also exists for special purposes.
  - Daylight film renders colours correctly when the illuminant is normal daylight or a source very similar to Source C.
  - Tungsten film renders colours correctly when a filament globe (tungsten bulb) is used for illumination.
- Quartz halogen globes provide a 'whiter' light (higher colour temperature) than traditional tungsten filament globes and are not ideal for use with either major colour film type.
- Monochrome films (black and white) also are categorized. The main categories are panchromatic (sensitive to all of the visible spectrum) and orthochromatic (sensitive to all of the visible spectrum except the deep red and orange wavelengths).
- Exposure refers loosely to the amount of light incident on a film. For a given film sensitivity, the three main factors governing exposure are: its duration (shutter speed), the aperture (the *f* stop) and the magnification.

Non-dedicated photo slit-lamps (slide 33) can be created by adapting a camera for use on a slit-lamp. Usually, the camera is mounted over one of the microscope eyepieces with a suitable adapter. However, photography reliant on the slit-lamp's normal illumination system is usually unsuccessful, even with high speed tungsten film. It is possible to use an external electronic flash for illumination However, the lack of collimation and control make the results somewhat unpredictable and entirely less satisfactory.

34



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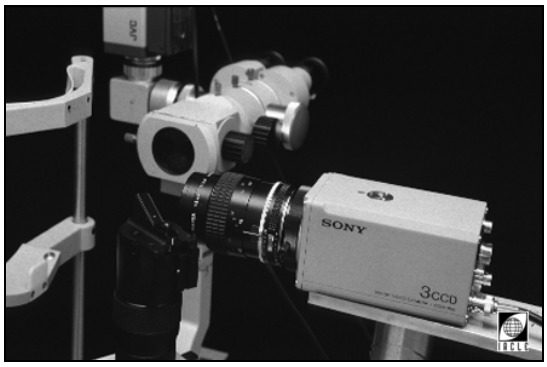

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Slit-Lamp Videography

Video slit-lamps may also be dedicated or non-dedicated. Dedicated video slit-lamps (slide 35), while more expensive, combine high quality imaging with ease of use. They are suited to a wide range of applications ranging from clinical research to public relations. Non-dedicated instruments require some ingenuity because most domestic video cameras do not have interchangeable lenses. The normal slit-lamp illumination system is usually sufficient for video purposes. Such cameras can be used in their macro mode (slide 36).

A good filing system is important for easy retrieval of both films and video cassettes. For slides, the mounts should be labelled properly and stored in a filing cabinet, while video cassettes should be returned to their boxes and filed on a shelf vertically. A database or other computer filing system can also be used if the size of the 'library' makes rapid access difficult.

NOTE: Slit-lamp photography and videography is discussed further in Unit 9.1.

IV.C Pachometry

37

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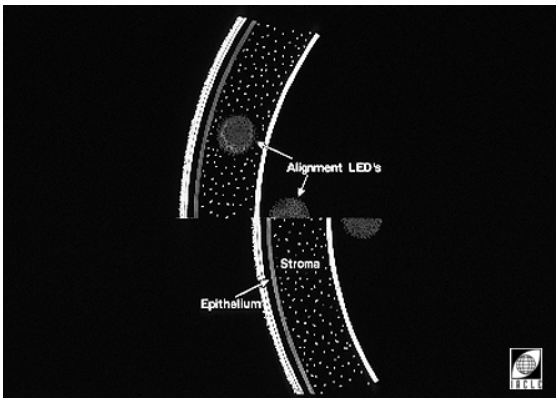
38



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Pachometry

Pachometry with a slit-lamp (slide 37) has been used primarily for research purposes. Applications include monitoring changes in corneal thickness with contact lens wear and in observing various corneal pathologies.

The pachometer attachment consists of a rotating glass plate mounted above a matching fixed plate. The microscope is equipped with a bi-prism eyepiece to view and separate the corneal optic section images (slide 38).

By using the rotating plate to achieve vernier alignment of the narrow sections (front of lower section to back of upper section), the corneal thickness can be read from the external scale attached to the rotating plate.

A computer can be programmed to convert and log the corneal thickness measurements and calculate statistical data (Holden *et al*., 1979 and 1982).

Greater accuracy was achieved by Crook (1979) by staining the tear film with fluorescein. Improvements in the standard error from 0.0144 (for unstained tears) to 0.0087mm were reported.

Practical 4.5

(4 Hours)

Slit-Lamp Examination for Contact Lens Evaluation & After-Care

Preliminary

Video Presentation: The Contact Lens Examination

Demonstration: 1. Fluorescein instillation

2. Upper lid eversion techniques

Practical Session 1

Instruction: The students are to be divided into four groups. They are to use the following observation techniques to evaluate the rigid and soft lenses fitted on each eye of the patient assigned for each group:

Station 1: Burton lamp (white light)

Station 2: Burton lamp (UV light)

Station 2: Slit-lamp (white light)

Station 3: Slit-lamp with Wratten filter

After completing all the stations, final fitting evaluations to be written on the Record Form provided.

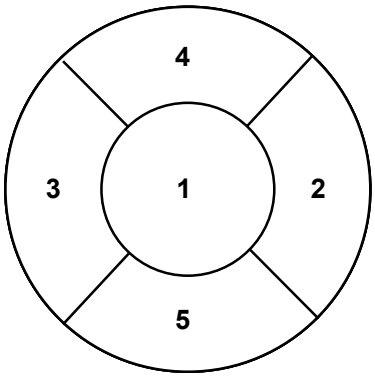
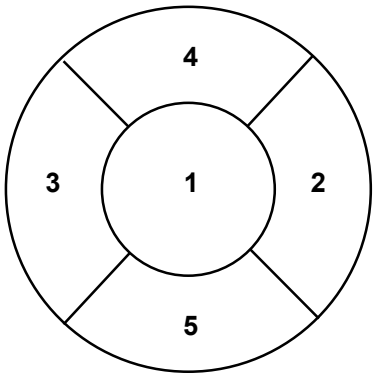
Discussion and Summary of Practical Session

SLIT-LAMP BIOMICROSCOPY		
Bulbar Conjunctiva		
Level of Redness	N 0 1 2 3 4 T 0 1 2 3 4 S 0 1 2 3 4 I 0 1 2 3 4	N 0 1 2 3 4 T 0 1 2 3 4 S 0 1 2 3 4 I 0 1 2 3 4
Pterygium	Nasal / Temporal	Nasal / Temporal
Pinguecula	Nasal / Temporal	Nasal / Temporal
Others	_____	_____
Tear Film		
Break-Up Time	_____sec.	_____sec.
Debris	0 1 2 3 4	0 1 2 3 4
Lipid Layer	0 1 2 3 4	0 1 2 3 4
	0 = Colourless/still; 1 = Colourless/marble; 2 = Colourless with black spots, 3 = Coloured fringes; 4 = Coloured fringes with black spots	
Tear Film	Blink pattern: Full ( ) Partial ( )	Blink pattern: Full ( ) Partial ( )
Limbal Conjunctiva		
Level of Redness	N 0 1 2 3 4 T 0 1 2 3 4 S 0 1 2 3 4 I 0 1 2 3 4	N 0 1 2 3 4 T 0 1 2 3 4 S 0 1 2 3 4 I 0 1 2 3 4
Vessel Penetration (mm)	N_____ T_____ S_____ I_____	N_____ T_____ S_____ I_____

Corneal Epithelium	Diagram Front View Slit View	Diagram Front View Slit View
Scars	Y / N	Y / N
Microcysts (No.)	_____	_____
Vacuoles (No.)	_____	_____
Infiltrates	_____ Y / N _____	_____ Y / N _____
Vessels	_____	_____
Other	_____	_____
Corneal Stroma		
Infiltrates	_____ Y / N _____	_____ Y / N _____
Striae (No.)	_____	_____
Folds (H/V/O)	_____	_____
Other	_____	_____

Corneal Endothelium		
Bedewing	0 1 2 3 4	0 1 2 3 4
Guttata	0 1 2 3 4	0 1 2 3 4
Bumpiness	0 1 2 3 4	0 1 2 3 4
Polymegethism	0 1 2 3 4	0 1 2 3 4
Pigment	0 1 2 3 4	0 1 2 3 4
Other	_____	_____

Corneal Staining

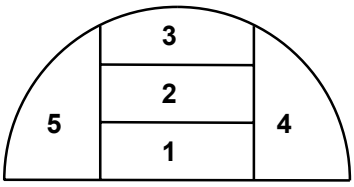
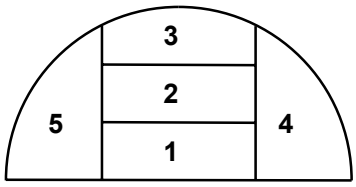
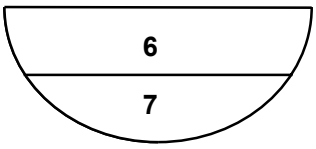
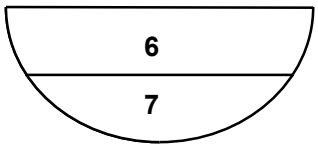
Extent: 0 = none 1 = mild discrete 2 = moderate discrete, mild coalescence 3 = severe discrete, moderate coalescence 4 = severe coalescence Depth: 0 = none 1 = superficial 2 = stromal glow within 30 secs. 3 = immediate stromal glow 4 = erosion confluent patch **List or draw types of staining.**		

	AREA 1	AREA 2	AREA 3	AREA 1	AREA 2	AREA 3
Extent	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Depth	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Type	_____	_____	_____	_____	_____	_____

	AREA 4	AREA 5	OVERALL	AREA 4	AREA 5	OVERALL
Extent	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Depth	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Type	_____	_____	_____	_____	_____	_____

Conjunctival Staining		
	N 0 1 2 3 4	N 0 1 2 3 4
	T 0 1 2 3 4	T 0 1 2 3 4
	S 0 1 2 3 4	S 0 1 2 3 4
	I 0 1 2 3 4	I 0 1 2 3 4

Palpebral Conjunctiva

						
	AREA 1	AREA 2	AREA 3	AREA 1	AREA 2	AREA 3
Redness	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Follicles	____Y/N___	___Y/N___	____Y/N___	____Y/N___	____Y/N____	____Y/N___
Papillae	____Y/N___	___Y/N___	____Y/N___	____Y/N___	___Y/N___	____Y/N___
Concretions	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Roughness	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	AREA 4		AREA 5	AREA 4		AREA 5
Redness	0 1 2 3 4		0 1 2 3 4	0 1 2 3 4		0 1 2 3 4
Follicles	____Y/N___		____Y/N___	____Y/N___		____Y/N___
Papillae	____Y/N___		____Y/N___	____Y/N___		____Y/N___
Concretions	0 1 2 3 4		0 1 2 3 4	0 1 2 3 4		0 1 2 3 4
Roughness	0 1 2 3 4		0 1 2 3 4	0 1 2 3 4		0 1 2 3 4
						
	AREA 6	AREA 7		AREA 6	AREA 7	
Redness	0 1 2 3 4	0 1 2 3 4	0 = Absent	0 1 2 3 4	0 1 2 3 4	
Follicles	____Y/N___	___Y/N___	1 = Very Slight	____Y/N____	____Y/N___	
Papillae	____Y/N___	___Y/N___	2 = Slight	___Y/N___	____Y/N___	
Concretions	0 1 2 3 4	0 1 2 3 4	3 = Moderate	0 1 2 3 4	0 1 2 3 4	
Roughness	0 1 2 3 4	0 1 2 3 4	4 = Severe	0 1 2 3 4	0 1 2 3 4	

CONTACT LENS EXAMINATION					
Specification of Patient's Lenses Type of Lens Base Curve BVP Diameter Lens Age					
Describe Lens Condition					
Recommendation for Trial Lens Fitting Type of Lens Base Curve BVP Diameter Lens Age					
Rx Given					

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Tutorial 4.5

(1 Hour)

Slit-Lamp Examination of Contact Lens Conditions

Quiz

Name:_____ **Date:**_____

Instruction. Answer the following questions on the space provided.

1. What is the best method for determining the depth of a corneal lesion? Explain the underlying principle.

_____
_____
_____
_____
_____

2. Why is the cornea visible with slit-lamp illumination?

_____
_____
_____
_____
_____

3. What slit-lamp illumination technique can best be used to examine the quality of the tear film?

_____
_____
_____
_____
_____

4. What slit-lamp illumination technique can best be used to examine the endothelial corneal structure?

_____
_____
_____
_____
_____

5. Why is fluorescein staining used as a routine procedure during slit-lamp examination?

_____
_____
_____
_____
_____

🕮 References

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