Managing Light to Enhance Visual Functioning

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Disclosure

I do not have any proprietary interest in or affiliation with any product, service, or material presented and/or discussed during your presentation.

Lighting

- The Impact of Lighting on Visual Functioning
- The Trends in Lighting Technologies
- Current Resources
- Lighting Assessments in the Home, School and Worksites

Common Complaints

- Too much light or glare
- Not enough light
- Both in differing situations
- Depends on environment/tasks/vision



Impact of Lighting Associated with Eye Problems

- Corneal dystrophies
- Changes in Lens: cataract, dislocation
- Iris function: iritis, uveitis, aniridia, albinism
- Vitreous; floaters, hemorrhages, detachment.
- Retina (light sensitive tissue, multi layers) drusens, bleeding, scarring, retinal changes (cones losing sensitivity), retinitis (inflammation), detachments.
- Optic Nerve damage
- Neurological

Glare

- Glare: scattering of light.
 - Intraocular
 - Objects and surfaces.
- Discomfort glare: reflective light that may be too intense or have variable brightness, easy to remediate.
 Enough discomfort to look away
- Disability Glare: reduces function, hazardous, unsafe

 Veiling glare: washed out images, foggy, environmental.
 Hazard glare: unable to function
- Can result in headaches, eye pain, loss of concentration, loss of visual functioning.







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Improving Situation

- Medical Intervention: MD, OD, LV
- Control Lighting

 Reduce, increase, filter, reposition, redirect, alter, angle, shield, diffuse, spread, type.

- Protect Eyes from light
 - sunglasses, cap, visor, veil, contact lenses
- Enhance Contrast

– Use of filters, lighting, alter environment

Sunglasses

- To reduce light and glare (outdoors and indoors)
 - Fit: wrap around, close to face, blockage
 - Transmission of light: amount of light
 - Tint: filtering specific spectrum of light

See your Orientation and Mobility Instructor

Lighting

- Natural Lighting
- Common Artificial Lighting

Naturally Occurring Light

- Sunlight, Moonlight, Starlight, Lightning, Fire, Bioluminescence, Chemiluminescence.
- Daylight/sunlight
- Often preferred, it's natural
- Complete visual spectrum
- But difficult to Control, Variable, Undependable
- Availability, Angle, Spread, Amount
- Windows, Skylights, Sunroom, Sliding Doors, Outdoors, In the Car,
- Shades, tinting, screens, awnings, sunglasses, visors, caps

Common Artificial Lighting

- LED, Halogen, Incandescent, Fluorescent, others
- Household, Office, Classroom
- Some lighting is fixed, other variable
- Old construction, new construction
- Wide range of color, intensity, spread, purpose

Task Specific Lighting

- Ambient Lighting: Orientation, safety
- Task Lighting
 - Lamps, replaceable/fixed bulbs: Floor, desk, clamp-on, head lamps, portable
- Decorative/Accent Lighting
 - Lamps, fixtures, overhead, special effects, room specific
- Combination



The Inverse Square Law of Light





How We Use It

- Bringing the light twice as close gives you four times the light.
- Four times closer gives 16 X the light.
- So the closer the light the intensity increase by the square of the reduced distance
- Also the further away the light the less intense.











Incandescent (tungsten)

- Since 1879, phased out 2014
- Familiar
- Heating a filament which glows, yellowish light
- High energy cost for limited light
- Large Thin Globe
- Inert Gas: Argon, nitrogen
- Not Efficient, Heat
- 750 hours
- 15 Lumens per Watt
- 60W=800 lumens



Halogen (incandescent)

- White hot light, higher efficiency
- Small strong Quartz Envelope
- Inert Gas; Halogen Family
- Redeposit Filament
- Longer life, 2000+ hours
- Very Hot
- 30% more light per watt
- 800 lumens = 42 watts (60w equiv)



Fluorescent (linear)

- Tube with Argon & Mercury Vapor
- Phosphors Coating stimulated by UV created by <u>Mercury</u> Vapor
- Tend to have UV/Bluish light
- Even, inexpensive, efficient
- Ambient; large coverage, office, store.
- Less Contrast, Some Flicker
- Cool White, Warm White (2700K to 6500K)
- Older; Magnetic Ballast, Newer: Electronic Ballast
- Approx 50 Lumens per Watt
- Life 9000 hours but on for longer periods



CFL

(compact fluorescent lights)

- Energy Savers, Inexpensive
- Warm white, cool white, daylight,
- Many styles; general, OTT, Verilux, Blue Max, etc.
 - 13w, 18w, <u>27w</u>, 42w (650 lms, 900 lms, 1350 lms, 3100 lms)
- Can be slow to get to full brightness
- Poor at low temperatures
- Fragile, **EPA clean up**.
- 50 lumens per watts
- 800 lumens= 12w
- 60W equiv
- 8000 hours



LED

Light Emitting Diodes

- Electronic devices: solid, circuitry to regulate voltage and current
- Runs on Direct Current
- Advancing exponentially
- Bulbs/lens, SMD, (surface mounted), COB (chip on board)
- Light Bulbs, Light Strips, Shop Lights
- 800 lumens = 9-10w (60w eqiv)

LEDs

- Advantages:
 - Low power usage, less heat, ex: snow w/traffic lights
 - Solid state
 - LED long life 10,000 hrs to 50,000 hrs
- Many dimmable, check
- Resources expanding very quickly
- Concerns:
 - Slowly dim out, ex: traffic lights replacements
 - Early design failures (regulators)
 - Quickly changing

LEDs Applications

- Replacement bulbs
- Lamps and Fixtures
- Magnifiers
- CCTVs
- Cell phones
- Flashlights
- Lanterns
- Headlamps
- Bike Lights
- Rated in Lumens

Surface Mounted Device



Circuit on Board (COB)









Lighting Facts (replacement bulbs/lamps)

- Brightness in Lumens
- Est. Yr Cost in dollars
- Life/Duration in Hours/Years
- Light Appearance in degrees Kelvin
- Energy Used in watts
- <u>CRI</u> color rendering index in %
- Other Info/Warnings

Lighting Factors

- Lumens: brightness of source
- 8 lumens to 2000 lumens +
- Compare: 60watts ~ 800 lumens +/-

SR. NO	LIGHTING OPTION	IMAGE	WATTAGE	LIGHT PER WATT	TOTAL LIGHT
1	Incandescent Bulb		60 W	13 Lumens per watt	800 Lumens
2	Tube Light (Fluorescent Lamp)		18 W	45 Lumens per watt	800 Lumens
3	CFL (Compact Fluorescent Lamp)		11 W	60 Lumens per watt	700 Lumens
4	LED (Light Emitting Diode)		9 W	100 Lumens per Watt	900 Lumens

Color Temperature Color appearance of the light

- Degrees Kelvin
- 2700 K (the common incandescent)
- Warm White (2700K)
- Cool White (3000K)
- Bright White (5000K)
- Daylight (6000K)
Home Depot/Lowes



Lighting Facts



Lighting Facts (portable systems)

- Modes
- Light Output
- Run Times
- Beam Distance
- Water Resistance/Submersible
- Impact Resistance
- http://www.energizer.com/lighting/ headlights#vhdflh



Blue Light Theory

- Higher frequency blue makes the retina work harder
- Lower frequency red is more comfortable
- •
- Classroom Concern: Fluorescent (economical).
- Use warm white lighting, warm non-glossy room colors, window controls, task lighting, glare filters, pastel papers.
- •
- Daylight and Full spectrum lighting: tries to mimic sunlight.
- Poor for ambient lighting, too harsh.
- Helpful for True Color
- Helpful for fine detail tasks
- Concern is prolonged use
- APH Better Vision Lamp



Resources (LED replacement bulbs)

- Warm white, cool white, bright white, daylight
- Lumens, design, weight, lamp compatibility, dimmer compatible
- LED bulbs: changing rapidly, prices coming down
- Multi color bulbs, Variable color bulbs





COLORCHOICE[™]

Three light color choices. One bulb.



Resources Floor Lamps

 Flexible neck, Full Spectrum/Daylight LED floor lamps.

- Stella, VeriLux, OTT, Daylight, Luxo, Dazor

- <u>Adjustable</u> Height Gooseneck Examination Lamp with LED bulb (to get light closer)
 - Brandt, Daylight, Luxo, Dazor





Desk Lamps

- Flexible arm
- Gooseneck
- Variable/selectable Brightness
- Full spectrum, multi-spectrum
- Dimmable
- Architect lamp with LED bulb
- LED office design

Desk/Table Lamps

- Wide range and type
 - Stella
 - -IVY
 - Verilux
 - OTT
 - Daylight
 - Architect lamps

Desk Lamps





Home Depot/Amazon



Specialty Lamps

- Magnifying Lamps
- Multi-function lamps
- Multi-color bulbs
- Philips HUE system

Specialty Lamps



The right light for whatever you're doing

Resources LED portables

- Flashlights
- Headlamps
- Lanterns
- Batteries
- Low Vision Devices



Flashlights

- Older Flashlights 20 lms to 150 lms
- Cree 300 lm mini/compact flashlight

 Battery options
- B&H Tac Light/Atomic Light 1600 lm
 Battery options



Cree Compact (one-mode)



B&H Taclight/Atomic Light



Headlights

- Eschenbach
- Eveready systems
- Camping/hiking/biking
- Specialty 1600 + lms



Lanterns

- Defiant Hanging
- Eveready
- Bushnell
- Automotive
- Camping/hiking
- Others





Contracting/Automotive Specialty/Sporting Goods









Current Resources

- Ivy Desk Lamp
- Stella Two Desk, Stella Sky Floor, Stella Edge
- Other variable brightness tri-spectrum lights
- Cree compact LED 300 lm Flashlight
 (one mode)
- Tac Light/Atomic Light
- Head Lamps (as needed)

Assessment

- Review Complaint
- Understanding of Characteristic of Vision Impairment
- Knowledge of Resources
- Assess environment/areas of concern

 <u>— Natural, ambient, tasks</u>, accent
- Determine tasks: specific activity
- Response to lighting factors

 Brightness, distance, color temp,
- Implement Plan
- Determine Success

Concerns

- Light entering eye directly ***
- Strain, discomfort, duration
- Hot spots, uneven/variable lighting
- Ambient Lighting; Room/Area Lighting
- Accent Lighting; Small area, enhance contrast
- Tasks Lighting; added lighting for task
 - Reading, sewing, crafts, computer, eating, workshop, finances, mail.

Room/Office Lighting

- Overhead lighting: direct, diffused, indirect
 Wellesley COA, Amazon
- Windows: shades, blinds, shutters, season
 Somerville HS
- Variable Lighting
 - Corridors, stair wells
- Task lighting

Equipment, tools, instruments

Tasks

- Spot viewing/identification
- Short-Term Viewing/short information
- Extended Viewing/prolonged reading
- Tools, Instruments, Equipment, Gauges
- ADLs, Safety

Approaches

- Color Temperature
 - Warm White
 - ambience, room lighting
 - Cool White
 - some tasks
 - Bright White/Daylight
 - highly preferred for detailed tasks
 - task lighting
 - Kitchen/bathroom areas

Common Situations

- Discomfort, strain, sustainability
- Reading
- Crafts, hobbies, ADLs
- Glare control
- Need for more light
- Portability
- Computers
- Electronic displays

Case Studies

- High School Student
- Theater Maintenance Worker
- Day Care Kitchen Chef
- Senior Orchard Grove
- Senior at Assistive Living in Reading
- Fox Hill Clients
- Library

High School Student

- Homework more of problem
- RP
- Needs More Light
- Portable for school
- Desk lamp for home
- Ambient light review










Theater Worker

- Works in dark environment
- Stargardt's disease
- Used handheld flashlight 100 lumens
- Demonstrated higher lumens, headlight and flashlight
- Excellent response



Energizer 100 lms



Assessed 1600 lms Zoom Systems









LED Flashlight

Cree T6 1600lm Zoom Bike Headlamp















Day Care Kitchen Chef

- Unevenly lit work areas
- Paperwork
- Diabetic retinopathy
- Has headlight and handheld flashlight
- Specific areas of concern
- Added lighting and bulb, provided flashlight















Assistive Living Apartment

- Not enough light
- Macular degeneration
- High ceiling, large open room, large windows
- Some area lighting okay
- Easy chair lighting needs attention













Fox Hill

- Senior Vision Assessments
- Macular Degeneration
- No specific complaints
- Good use of lighting












Medical Center Receptionist

- Needs bright task lighting
- Sensitive to ambient lighting
- Retinitis Pigmentosa
- Task lighting
- Repositioning, sunglasses or valances







Assistive Living

- Too much light in some situations
- Needed more light for detailed tasks
- In process of an apartment move













Antique Library (1879)

- Use of daylight and added fixtures
- Retrofitted
- Pendant lighting
- Hot spot/Dark areas
- Glare









\$35 m Renovation Opening Saturday



Newer Construction Shaw's Chestnut Hill All LEDs



Summary

- Low Vision intervention
- Beware of light entering the eye directly
- Bright direct lighting
- Newer and greater resources
- Assess concerns and specific tasks
- In the end it is all subjective

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Thank You

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