

# The Role of the Dispensing Optician in Colour Vision Testing and the Prescribing of Tints

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## Content

- Classification
- Defects
- Testing
- Occupational Requirements
- Prescribing
- Occupational needs

## Classification

- Congenital
- Acquired

## Classification

- Congenital:
  - Approximately 8.5% of population have defects – 0.5% of these are women
  - Sex-linked recessive inheritance
  - Women tend to be “carriers” rather than sufferers
  - Inheritance patterns can be complicated and MAY need exact knowledge of family history to be sure

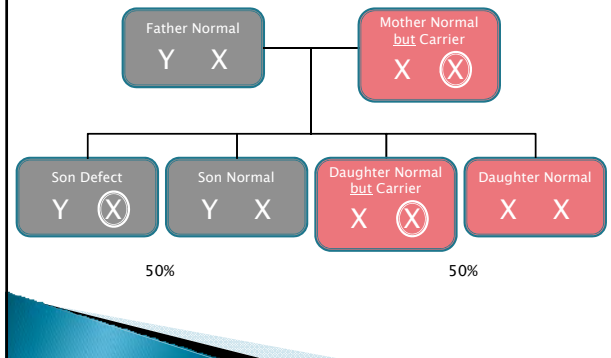
## Classification

- Congenital:
  - Monochromacy
    - Very rare
    - Absence or non function of cones or rods
  - Dichromacy
    - More common
    - Absence or non function of one colour system
  - Anomalous Trichromacy
    - Most common
    - Reduced sensitivity in one colour system

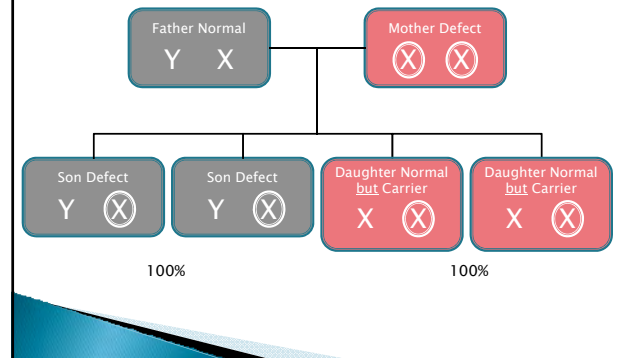
## Inheritance

- Genes carried on the X chromosome
- Prevalence in males higher
  - Single defective X chromosome = colour vision defect
- In females
  - 1 functioning gene (out of 2) = viable photopigments

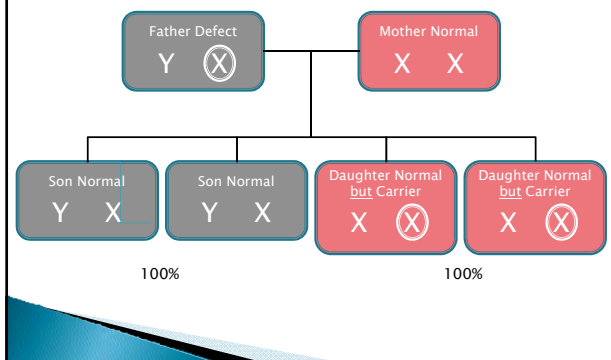
## Inheritance



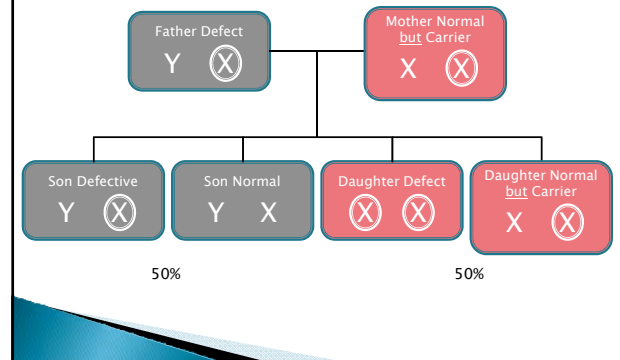
## Inheritance



## Inheritance



## Inheritance



## Classification

- ▶ Acquired:
  - Presentation different;
    - Tend to be older patients
    - May be aware of changing perception e.g. increasing TV colour saturation
    - May be in one eye only
  - More likely to be blue yellow defect
    - Testing needs to accommodate this
  - May be toxic with identifiable associations eg. Hydroxychloroquine

## Defects

- ▶ Colour vision 3 component system:
  - Green – (most sensitive) peak at 534–555 nm
  - Red – peak at 564–580 nm
  - Blue – (least sensitive) peak at 420–440 nm
- ▶ Defects named after defective or absent system:
  - Deutan (Green)
  - Protan (Protan)
  - Tritan (Blue)

## Defects

- ▶ Dichromats
  - Deuteranopia – 1% of males, 0.02% of females
  - Protanopia – 1% of males, 0.02% of females
  - Tritanopia – 0.001% of males and females
- ▶ Anomalous Trichromats
  - Deuteranomaly – 5% of males, 0.4% of females
  - Protanomaly – 1% of males, 0.01% of females
  - Tritanomaly – Uncertain (v rare)

## Defects

- ▶ Practical effects
  - Colour confusions
  - Hue discrimination poor
    - Colour mixes of Red/Green look alike
    - Variety of muddy browns

## Testing

- ▶ Colour identification
  - Lantern tests
- ▶ Colour matching
  - Anomaloscope
- ▶ Colour confusion (discrimination)
  - Psuedoiso chromatic plates
  - Farnsworth Munsell
- ▶ Trade tests

## Testing

- ▶ Lantern tests
  - (Formerly) widely used for occupational testing
  - Only tests where colour naming is required
    - Replicates real life situation (signal lights)
  - Less commonly used now
    - CAA no longer automatically use it for pilots; BUT
    - Holmes Wright still specified for Armed Forces
    - CAM currently available – duplicates Holmes Wright

## Testing

- ▶ Colour matching
  - Anomaloscope
    - Nagel
    - OCULUS HMC
  - Online
    - [www.color-blindness.com/rgb-anomaloscope-color-blindness-test/](http://www.color-blindness.com/rgb-anomaloscope-color-blindness-test/)

## Testing

- ▶ Colour confusion (discrimination)
  - Easy to use in practice
  - Psuedoiso chromatic plates
    - Ishihara
    - HRR
    - SPP
  - Farnsworth Munsell
    - 100 Hue
    - D15
    - City University

## Pseudoisochromatic plates

### ▶ Ishihara Test

- Almost universally used
- Plus points
  - Easy to administer
  - Reasonable discrimination
  - Very sensitive
- Negative points
  - Poor at quantifying
  - Very sensitive
  - No Tritan testing

## Ishihara Test

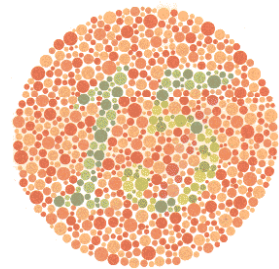
- ▶ Northern daylight
- ▶ White light – Standard Illuminant C, around 6,500 °K
- ▶ Macbeth Easel
- ▶ Daylight fluorescent tube
- ▶ DON'T use Tungsten bulbs or "warm" lamps
- ▶ View plates at 75cms for approx 3-5 seconds each

## Ishihara Test

- ▶ Northern daylight
- ▶ White light – Standard Illuminant C, around 6,500 °K
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- ▶ View plates at 75cms for approx 3 seconds each

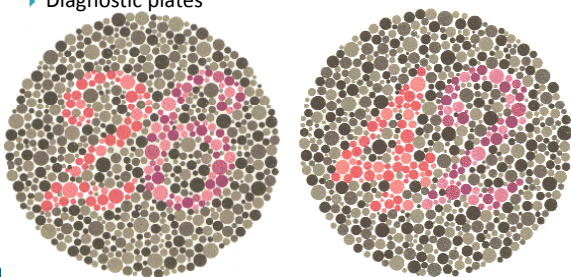
## Testing – Ishihara

- ▶ Plate 1
  - Control plate
  - Check test understanding
  - Identify malingerers
- ▶ Plates 2-21 (38 plate version)
  - Variety of digits
  - Some seen by normals, some by colour defectives; BUT
  - Low sensitivity and specificity



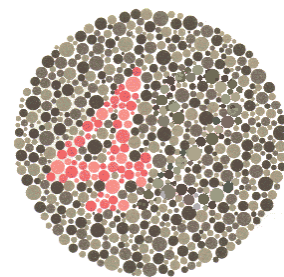
## Testing – Ishihara

- ▶ Plates 22-25 (38 plate version)
- ▶ Diagnostic plates



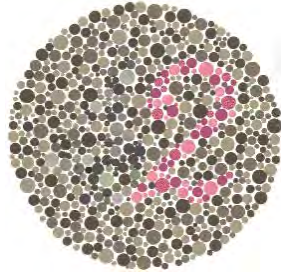
## Testing – Ishihara

- ▶ Deutan defects see the reddish dots and confuse the purple dots with the grey background
- ▶ Deuteranope
  - Sees 4 and not 2
- ▶ Deuteranomalous
  - Sees 4 and 2 dim



## Testing – Ishihara

- ▶ Protan defects see the purple dots and confuse the reddish dots with the grey background
- ▶ Protanope
  - Sees 2 and not 4
- ▶ Protanomalous
  - Sees 2 and 4 dim



## Testing – Acquired

- ▶ Test each eye separately
- ▶ Include Tritan
  - D15
  - City University

## Occupational Requirements

- ▶ Need to know specific standard required
- ▶ Many (most?) rely on the Ishihara as primary test
- ▶ Follow up variable
  - City or D15
  - Lantern
  - Trade

## Occupational Requirements

- ▶ Civilian Flying
  1. Ishihara
  2. Anomaloscope
- ▶ Military
  - Varies according the branch and role
- ▶ Merchant Marine
  1. Ishihara
  2. Holmes Wright
- ▶ Railways
  - Ishihara or City University
  - Trade test
- ▶ Driving
  - None
- ▶ [www.aop.org.uk/practitioner-advice/vision-standards/](http://www.aop.org.uk/practitioner-advice/vision-standards/)

## Advising Patients

- ▶ If there is a specific standard;
  - Ensure lighting appropriate
  - Apply specific test
  - Advise patient
- ▶ If not;
  - Try Ishihara test – if they pass they can pass anything
  - Report results
  - May need follow-up

## Advising Employers

- ▶ Absence of a specific standard can make it difficult
- ▶ Ishihara passes suitable for most (all?) occupations
- ▶ Failures?
  - Another test?
  - Trade test
- ▶ Avoid commenting on “suitability”

## Prescribing/Advising Tints

- ▶ If not found if not specifically prescribed in eye examination
- ▶ Neutral colour
  - Grey
  - Brown
- ▶ Consider spectral transmission if patient colour defective, ie:
  - Less long wave absorption for protan defects
  - Less short/med wave absorption for deutan defects

## Prescribing/Advising Tints

- ▶ If not found clinically necessary in eye examination ????
- ▶ Neutral colour
  - Grey
  - Brown
- ▶ Consider spectral transmission if patient colour defective, ie:
  - Less long wave absorption for protan defects
  - Less short/med wave absorption for deutan defects

## Prescribing/Advising Tints

- ▶ Use of tints for specific occupational need:
- ▶ Selective absorption to produce contrast difference
  - Fruit pickers
    - Discrimination of ripe from unripe
    - May need some experimentation
    - X-Chrom
- ▶ Wavelength "modification"
  - ChromaGen
- ▶ May not be suitable for constant wear
  - Beware of unexpected consequences
  - Prohibited for certain occupations

## Role of the Dispensing Optician

- ▶ Colour vision testing NOT a restricted function; BUT
  - Skill and competence required
- ▶ Interesting and rewarding area of practice
  - Career guidance
  - Vocational guidance
- ▶ Expertise lacking in many practices
- ▶ Bank of tests not hugely expensive
- ▶ Have A Go!

**Thank You for Listening**