Astigmatic Refractive Error: Types of Astigmatism

*Basic Optics*, Chapter 14
Types of Astigmatism

Can you determine which type of astigmatism a patient has, just by evaluating their refraction? **YES**
Types of Astigmatism

- To determine astigmatism type:
  1) Express the refraction in both plus- and minus-cylinder formats
Types of Astigmatism

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2) Note the **sign of the sphere** component in each format—together, they indicate the type
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<table>
<thead>
<tr>
<th>Sphere Signs</th>
<th>Type of Astigmatism</th>
</tr>
</thead>
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<td>Minus/Minus</td>
<td>Compound Myopic</td>
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<tr>
<td>Minus/Plano</td>
<td>Simple Myopic</td>
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<tr>
<td>Plus/Minus</td>
<td>Mixed</td>
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Types of Astigmatism

- Compound Myopic: Minus/Minus
- Simple Myopic: Minus/Plano
- Mixed: Minus/Plus
- Simple Hyperopic: Plano/Plus
- Compound Hyperopic: Plus/Plus
Types of Astigmatism

Examples: Determine the type of astigmatism present for each of the following refractions:
Types of Astigmatism

- +3.0 -2.0 x 080
Types of Astigmatism

- $+3.0 -2.0 \times 080$
  - In plus cylinder: $+1.0 +2.0 \times 170$
Types of Astigmatism

- **+3.0 -2.0 x 080**
  - In plus cylinder: **+1.0 +2.0 x 170**
  - The spherical component is *plus* in both plus- and minus-cylinder format, therefore, it indicates

  **Compound Hyperopia**
Types of Astigmatism

- +1.0 -4.0 x 080
Types of Astigmatism

- +1.0 -4.0 x 080
  - In plus cylinder: -3.0 +4.0 x 170
Types of Astigmatism

- **+1.0 -4.0 x 080**
  - In plus cylinder: **-3.0 +4.0 x 170**
  - The spherical component is *plus* in minus-cylinder format but *minus* in plus-cylinder format, therefore, it indicates

  *Mixed Astigmatism*
Types of Astigmatism

-5.0 +9.0 x 090
Types of Astigmatism

- $-5.0 +9.0 \times 090$
  - In minus cylinder: $+4.0 -9.0 \times 180$
Types of Astigmatism

-5.0 +9.0 x 090

- In minus cylinder: +4.0 -9.0 x 180
- The spherical component is *plus* in minus-cylinder format but *minus* in plus-cylinder format, therefore, it indicates

  *Mixed Astigmatism*
Types of Astigmatism

-2.5 +1.5 x 128
Types of Astigmatism

-2.5 +1.5 x 128
- In minus cylinder: -1.0 -1.5 x 038
Types of Astigmatism

-2.5 +1.5 x 128

- In minus cylinder: -1.0 -1.5 x 038
- The spherical component is \textit{minus} in both minus- and plus-cylinder formats, therefore, it indicates \textbf{Compound Myopia}
Classification of Astigmatism
Classification of Astigmatism

- **With-the-Rule** and **Against-the-Rule**
  - Old terms, still in use
  - Useful because they facilitate communication between ophthalmologists and other ophthalmic professionals (optometrists, opticians)
Classification of Astigmatism

- *With-the-Rule* and *Against-the-Rule* cont
  - Why might our ‘communications’ need facilitating?
Classification of Astigmatism

- *With-the-Rule* and *Against-the-Rule* cont
  - Why might our ‘communications’ need facilitating?
    - The way we work is a potential source of confusion
      - Ophthalmologists usually refract in *plus* cylinder
        - Easier (for the refractionist)
      - Optometrists often refract in *minus* cylinder
      - Opticians ‘think’ in *minus* cylinder
        - Glasses are ground in minus cylinder
Classification of Astigmatism

- **With-the-Rule** and **Against-the-Rule** cont

  - Why might our ‘communications’ need facilitating?
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Consider: If an ophthalmologist says to an optom ‘this patient has a lot of cyl at 180°,’ the MD is thinking in plus cyl, but the OD is thinking in minus--each has the *opposite* impression from her counterpart! But if the MD says ‘this patient has a lot of with-the-rule astigmatism,’ both will be on the same page.
Classification of Astigmatism

- *With-the-Rule* Astigmatism
  - So named because it is the more common type
Classification of Astigmatism

- **With-the-Rule** Astigmatism
  - So named because it is the more common type
  - Cornea is shaped like a football lying on the ground (assuming astigmatism is corneal)
Classification of Astigmatism

- **With-the-Rule** Astigmatism
  - So named because it is the more common type
  - Cornea is shaped like a football lying on the ground (assuming astigmatism is corneal)
  - More plus power at ~090 meridian (axis 180)
  - Corrected with:
    - plus cylinder power at the 180 meridian (axis 090), or
    - minus cylinder power at the 090 meridian (axis 180)

Doesn’t have to be at exactly 090/axis 180; +/- up to 20° still counts
Classification of Astigmatism

- *Against-the-Rule* Astigmatism
  - So named because it is the less common type
Classification of Astigmatism

- **Against-the-Rule** Astigmatism
  - So named because it is the less common type
  - Cornea is shaped like a **football standing on a tee**
    (again, assuming astigmatism is corneal)
Classification of Astigmatism

- **Against-the-Rule Astigmatism**
  - So named because it is the less common type
  - Cornea is shaped like a football standing on a tee (again, assuming astigmatism is corneal)
  - More plus power at ~180 meridian (axis 090)
  - Corrected with:
    - plus cylinder power at the 090 meridian (axis 180), or
    - minus cylinder power at the 180 meridian (axis 090)
Classification of Astigmatism

- Comparing astigmatism types
  - In young people, with-the-rule is far more common than against-the-rule
Comparing astigmatism types

- In **young people**, *with-the-rule is far more common than against-the-rule*
  - *Tight Eyelids* hypothesis
    - Young eyelids are tight → pressure on the upper and lower cornea → vertical meridia steepened → with-the-rule astigmatism
  - Some refractive surgeons will not operate on a young person with corneal against-the-rule astigmatism
    - Consider it to be prima facie evidence of corneal ectasia
Comparing astigmatism types

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- In the elderly, *against-the-rule is more common*