FUNDAMENTALS OF SUBJECTIVE REFRACTION

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COURSE OBJECTIVES

1. Identify relevant components of the phoropter for subjective refraction.
2. Explain the steps of subjective refraction.
3. Describe tips for troubleshooting during subjective refraction.
PHOROPTER INTRODUCTION

• The phoropter is, “a complex lens holder designed to allow the examiner to change lenses efficiently and easily.”

• It is commonly used for subjective refraction at distance and near, as well as binocular and accommodative testing.
Sphere dial

Sphere power scale
JCC unit

Red dots for minus axis orientation: usually -0.25 D

White dots for plus axis orientation: usually +0.25 D
“The goal of subjective refraction is to develop and refine a prescription through which the patient can see comfortably.”²
SUBJECTIVE REFRACTION OVERVIEW

1. Initial sphere check
2. Cylinder axis refinement
3. Cylinder power refinement
4. Second sphere check
5. +0.50 check
6. Repeat steps 1-5 for other eye
7. Binocular balance
WHERE TO BEGIN

• You can begin your refraction from 4 different starting points:
  – Retinoscopy results
  – Autorefraction results
  – Lenometry measurements
  – From scratch - with no objective measurements (beyond the scope of this lecture)
WHERE TO BEGIN

• We will begin from our retinoscopy findings.
• For purposes of this lecture, the retinoscopy findings are the following:
  – Retinoscopy working distance of 50 cm (2.00 D)
  – OD: +3.00-1.00 x180
  – OS: -2.00-2.25 x116
• For purposes of this lecture, we will also be assuming the use of the Snellen chart in the directions.
  – Visual acuity (VA) units and directions can be converted or modified based upon the chart being used.
INITIAL SPHERE CHECK

Starting point from retinoscopy:
OD: +3.00-1.00 x180

Oclude the left eye
QUESTION #1

• What is the expected refraction based on the retinoscopy findings (with a working distance of 50 cm)? OD: +3.00-1.00 x180
  a) +3.00-1.00 x180
  b) +1.50-1.00 x180
  c) +1.00-1.00 x180
  d) Plano-1.00 x180
QUESTION #1

What is the expected refraction based on the retinoscopy findings (with a working distance of 50 cm)? OD: +3.00-1.00 x180

a) +3.00-1.00 x180
b) +1.50-1.00 x180
c) +1.00-1.00 x180
d) Plano-1.00 x180
INITIAL SPHERE CHECK

OD: +3.00-1.00 x180

1A. Show the Snellen chart with the 20/60 (6/18) line at the top. Ask the patient, “Tell me as soon as you can read the top line.”
INITIAL SPHERE CHECK

OD: +3.00-1.00 x180

1B. Reduce the plus sphere power by +0.25 at a time.

Tip: If the patient is never able to read the top line, increase the letter size.
INITIAL SPHERE CHECK

OD: +2.75-1.00 x180

2. Once the patient can read the 20/60 (6/18) line, continue reducing the plus sphere power until the best VA is achieved.

As you change the sphere power ask the patient, “What is the lowest line that you can read?”

*Tip: Isolating lines can be helpful if the patient is having difficulty*
INITIAL SPHERE CHECK

OD: +1.25-1.00 x180

Note: If the patient’s VA does not improve with additional changes to the sphere power, go back to the last sphere lens that improved VA.

• VA at this point is 20/25 (6/7.5)
Target: Isolate one line above the best VA = 20/30 (6/9) in this case

3. Insert the JCC in AXIS position.

Directions: “I’m going to show you two views. I want you to tell me which is clearer or if they look the same.”
CYLINDER AXIS
REFINEMENT

AXIS position:

Red and white dots on either side of the arrows
CYLINDER AXIS REFINEMENT

View 1

“This is 1”
“This is 2. Which is clearer or do they look about the same?”

“Both may be blurry, but is one better than the other.”
QUESTION #2

• If the patient chooses view #1, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE
QUESTION #2

• If the patient chooses view #1, what adjustment should be made?
  a) Decrease the cylinder power
  b) **Rotate the cylinder axis CLOCKWISE**
  c) Increase the cylinder power
  d) **Rotate the cylinder axis COUNTER CLOCKWISE**
In our scenario, the patient chooses view #1.

4. Rotate toward the red dots - CLOCKWISE
CYLINDER AXIS REFINEMENT

5. Repeat steps 3 and 4 until axis is finalized.

+1.25-1.00 x170

Tip: You can make larger adjustments for smaller cylinder power and vice versa
6. Switch to POWER position. Give the same directions for axis refinement.

“Which is better, 3 or 4?”
CYLINDER POWER REFINEMENT

POWER position:

Red and white dots line up with the arrows
Tip: You can use numbers 1-10 when giving the patient choices, but I usually use 1 or 2 and 3 or 4 to keep it simple.
CYLINDER POWER REFINEMENT

“This is 3”
CYLINDER POWER REFINEMENT

“This is 4.”
QUESTION #3

- If the patient chooses view #3, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE
QUESTION #3

- If the patient chooses view #3, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE

View 3
CYLINDER POWER REFINEMENT

In our scenario, the patient chooses view #3.

7. Since the patient chose the WHITE dots, REDUCE the cylinder power by 0.25.
Note:
Red dots = increase cylinder power

White dots = decrease cylinder power

8. Repeat steps 6 and 7 until power is finalized.
CYLINDER POWER REFINEMENT

At this point in the refraction:

+1.25-0.75 x170
SECOND SPHERE CHECK

OD: +1.25-0.75 x170

9A. Add +0.50 or +0.75 to begin this step.

OD: +2.00-0.75 x170

Target: Show multiple lines of the VA chart with 20/20 (6/6) at the bottom
SECOND SPHERE CHECK

9B. Reduce the plus sphere power in +0.25 steps.

As you change the sphere power ask the patient, “What is the lowest line that you can read?”
SECOND SPHERE CHECK

OD: +1.25-0.75 x170

Best corrected VA:
20/20 (6/6)
**+0.50 CHECK**

OD: +1.25-0.75 x170

10. Add +0.50 to your final refraction.

OD: +1.75-0.75 x170

Ask the patient, “What happens when I do this? Does the line get blurry?”

The patient should respond that the lowest line becomes blurry. If not, the patient is overminused.
REPEAT FOR OS

Occlude OD
INITIAL SPHERE CHECK

OS: -2.00-2.25 x116

11. Show the 20/60 (6/18) line at the top. “Tell me as soon as you can read the top line.” Reduce the plus sphere power by +0.25 at a time.

Tip: Think in terms of reducing the plus power or increasing the minus power.
INITIAL SPHERE CHECK

OS: -3.50-2.25 x116

12. “What’s the lowest line you can read?”

<table>
<thead>
<tr>
<th>Sphere</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.50</td>
<td>20/30 (6/9)</td>
</tr>
<tr>
<td>-3.75</td>
<td>20/30 (6/9)</td>
</tr>
<tr>
<td>-4.00</td>
<td>20/30 (6/9)</td>
</tr>
</tbody>
</table>
INITIAL SPHERE CHECK

Since the VA does not improve with the increase in minus power, we will go back to the last sphere power that improved VA

-3.50-2.25 x116
Target: Isolate one line above the best VA = 20/40 (6/12) in this case

13. Insert the JCC in AXIS position.

Directions: “I’m going to show you two views. I want you to tell me which is clearer or if they look the same.”
CYLINDER AXIS REFINEMENT

View 1

“This is 1”
CYLINDER AXIS REFINEMENT

View 2

“This is 2”
QUESTION #4

- If the patient chooses view #2, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE
QUESTION #4

If the patient chooses view #2, what adjustment should be made?

a) Decrease the cylinder power
b) Rotate the cylinder axis CLOCKWISE
c) Increase the cylinder power
d) Rotate the cylinder axis COUNTER CLOCKWISE
In our scenario, the patient chooses view #2.

14. Rotate toward the red dots – COUNTER CLOCKWISE
15. Repeat steps 13 and 14 until axis is finalized.

Tip: Remember, for larger amounts of cylinder, use smaller axis changes.
16. Switch to POWER position. Give the same directions for axis refinement.

“Which is better, 3 or 4?”
CYLINDER POWER REFINEMENT

“This is 3”
CYLINDER POWER REFINEMENT

“This is 4.”
QUESTION #4

• If the patient chooses view #4, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE
QUESTION #4

• If the patient chooses view #4, what adjustment should be made?
  a) Decrease the cylinder power
  b) Rotate the cylinder axis CLOCKWISE
  c) Increase the cylinder power
  d) Rotate the cylinder axis COUNTER CLOCKWISE
CYLINDER POWER REFINEMENT

In our scenario, the patient chooses view #4.

17. Since the patient chose the RED dots, INCREASE the cylinder power.
CYLINDER POWER REFINEMENT

Note:
Red dots = increase cylinder power

White dots = decrease cylinder power

18. Repeat steps 16 and 17 until power is finalized.
CYLINDER POWER REFINEMENT

At this point in the refraction:

-3.50-2.50 x125
SECOND SPHERE CHECK

OS: -3.50-2.50 x125

19A. Add +0.50 to +0.75 to begin this step.

OS: -3.00-2.50 x125

Target: Show multiple lines of the VA chart with 20/20 (6/6) at the bottom
SECOND SPHERE CHECK

19B. Reduce the plus sphere power in +0.25 steps.

As you change the sphere power ask the patient, “What is the lowest line that you can read?”
SECOND SPHERE CHECK

OS: -3.75-2.50 x125

Best corrected VA:
20/20 (6/6)
+0.50 CHECK

OS: -3.75-2.50 x125

20. Add +0.50 to your final refraction.

OS: -3.25-2.50 x125

Ask the patient, “What happens when I do this? Does the line get blurry?”

The patient should respond that the lowest line becomes blurry. If not, the patient is overminused.
BINOCULAR BALANCE

Successive alternate occlusion
• Only works with equal best corrected VA

21. Add +0.75 or +1.00 sphere power OU
**Target:** 20/50 (6/15) or 20/60 (6/18) isolated line

*Tip:* Make sure the patient can read the line with each eye.

22. **Directions:** “I’m going to cover one eye at a time. Both views will be blurry, but I want you to tell me which view is clearer or if they look the same.”
BINOCULAR BALANCE

OD: +2.00-0.75 x170  OS: -3.00-2.50 x125
BINOCULAR BALANCE

View 1 with OS occluded
BINOCULAR BALANCE

View 1 with OS occluded
BINOCULAR BALANCE

View 2 with OD occluded
View 2 with OD occluded
Patient states that View 2 is clearer
BINOCULAR BALANCE

23. Add +0.25 to OS = -2.75-2.50 x125
24. Repeat steps 22 and 23 until the patient reports that views are equal.

**Tip:** If the patient never reports that the views are equal, leave the dominant eye slightly clearer.

Our patient now reports that views are equal.

25. Reduce the plus power binocularly, checking the VA after each +0.25 step.
Final Rx: OD: +1.25-0.75 x170   OS: -3.50-2.50 x125
FUTURE CONSIDERATIONS

• Refractive procedure when no cylinder is found on objective testing
• Starting a subjective refraction without objective findings
• Different methods for:
  – Cylinder determination
  – Check tests
  – Binocular balance
REFERENCES

THANK YOU

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