14 Normative centering tolerance in case of cylindrical lens centering

14.1 Introduction

Binocular tolerance in cylindrical lenses comes from the same norms according the need of Association of Czech opticians and optometrists (2006). Maximal possible decentration is presented in lower table.

Table 14.1: Astigmatic cylinder rotation tolerance in degrees (Benes et al. 2010)

corrective cylinder	axis tolerance in degrees
0,25 − 0,75	±5
<1,00 ≥ 1,5	±3
≤ 1,75 − 6	±2

If we incorrectly centre the astigmatic axis in cylinder we can decrease visual acuity. Value of the vertex refraction of the cylinder induced during incorrect centration can be calculated according formula written below

$$\Delta S'_B(cyl) = 2.S'_B cyl.\sin\beta \qquad S'_B \text{ [D]}, \boldsymbol{\beta} \text{ [°]} \qquad (15)$$

S'_B cyl = original cylindrical value, $\boldsymbol{\beta}$ = axis incorrectness

14.2 Goals

- Calculate difference of induced cylindrical value on given cylindrical lens if we turn axis incorrectly 5 degrees
- Calculate incorrect axis rotation if we induce difference astigmatic error 1.25 D
- Decide if you can accept incorrectly turned lens with cylinder 2 D. Incorrect rotation is 3 degrees

14.3 Equipment

Sphere-cylindrical spectacle lenses, calculator, writing equipment

14.4 Methods

Calculate difference cylindrical value on given cylindrical lens if we turn axis incorrectly 5 degrees

Calculate incorrect axis rotation if we induce difference astigmatic error 1.25 D

Decide if you can accept incorrectly turned lens with cylinder 2 D. Incorrect rotation is 3 degrees

To calculation use this formula:

$$\Delta S'_B(cyl) = 2.S'_B cyl . sin\beta \qquad S'_B\ [D],\ \pmb{\beta}\ [°] \qquad (16)$$

14.5 Results

Calculate difference cylindrical value on given cylindrical lens if we turn axis incorrectly 5 degrees

Δ S'$_B$ (cyl) =

Calculate incorrect axis rotation if we induce difference astigmatic error 1.25 D

β =

Decide if you can accept incorrectly turned lens with cylinder 2 D. Incorrect rotation is 3 degrees

YES/NO

14.6 Discussion

If we induce unwanted difference astigmatism we should realize that in the lens raises incorrect astigmatic correction according the principal of Jackson's cylinder. For example if we induce astigmatism 0.26 D we also induce sphere error -0.13 D. It was empirically found that already 0.12 D of incorrect astigmatism lead to decreasing of visual acuity. So we can conclude that 1 D cylinder should be centered with exactness 2.5 degrees.

14.7 Conclusion, notes, comments

Check marking device on lensmeter. Use transparent desk and mark it in the same axis from both sides. Half of measured value show us incorrectness of the marking device.