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Spectacle technique II

Practical exercises

MASARYK UNIVERSITY

Table of Contents

1 Calculation of horizontal decentration of spectacle lens in spectacle frame 1

2 Calculation of spectacle lens vertical decentration..... 3

3 Spectacle lens vertex distance measurement..... 6

4 Spectacle frame pantoscopic angle measurement 9

5 Spectacle frame wrap angle measurement..... 11

6 Spectacle frame pressure relation measurement..... 13

7 Spectacle frame static relationship measurement 16

8 Aniseikonia correction with spectacle frame adaptation 19

9 Taxation of the prescription for spectacles and optical aid 21

10 Choice and recommendation of spherical/cylindrical single vision lens from the catalogue..... 25

11 Choice and recommendation of bifocal lens from the catalogue..... 28

12 Choice and recommendation of progressive and degressive lens from the catalogue 31

13 Choice and recommendation of lenticular lens from the catalogue 34

14 Choice and recommendation of prismatic lens from the catalogue..... 37

Literature..... 40

1 Calculation of horizontal decentration of spectacle lens in spectacle frame

1.1 Introduction

Position of the spectacle lens centration point is equal to optical spectacle lens in lenses without prismatic effect (Rutrle, 2001). Position of the spectacle centration we can find out if we draw points (pupil position) with the pencil right on the demo-foil or we can calculate it without drawing on demo-foil (see exercise 5 in Spectacle lens technique I).

1.2 Goals

- Measure pupillary distance of the patient
- Measure size of the frame according the boxing system
- Measure size of the bridge according the boxing system
- Calculate the size of horizontal decentration in relation to centre of the eye frame for right and left side

1.3 Equipment

Digital and handy PD meter, writing equipment, spectacle frame

1.4 Methods

Measure pupillary distance of the patient

Use digital or handy PD meter and measure pupillary distance right and left.

Measure size of the frame according the boxing system

Measure size of the spectacle frame (from center of the right eye frame to the left eye frame).

Measure size of the bridge according the boxing system

Measure size of the spectacle bridge. It is size from the edge of right eye frame to the edge of the left eye frame. Use boxing system.

Calculate the size of horizontal decentration in relation to centre of the eye frame for right and left side

According the bellow formula, calculate size of the horizontal decentration for right and left spectacle lens (h – horizontal decentration right and left, c – frame size, PD is pupillary distance right and left)

$$h_{R,L} = \frac{c}{2} - (PD_{R,L}) \qquad \text{[mm]} \qquad (16)$$

1.5 Results

Measure pupillary distance of the patient

PD_R =

PD_L =

Measure size of the frame according the boxing system

c =

Measure size of the bridge according the boxing system

d =

Calculate the size of horizontal decentration in relation to centre of the eye frame for right and left side

h_R =

h_L =

Draw schematically spectacle frame according boxing system and measure and mark its parameters.

1.6 Discussion

The size of the horizontal decentration is important for proper grinding of the spectacle lens. If the grinding is manual we use TABO-schema for decentration of the spectacle lens. If we use automated grinding machine we put horizontal decentration data in to the centration instrument called tracer.

1.7 Conclusion, notes, comments

Which type of horizontal decentration calculation would you choose for your practice?

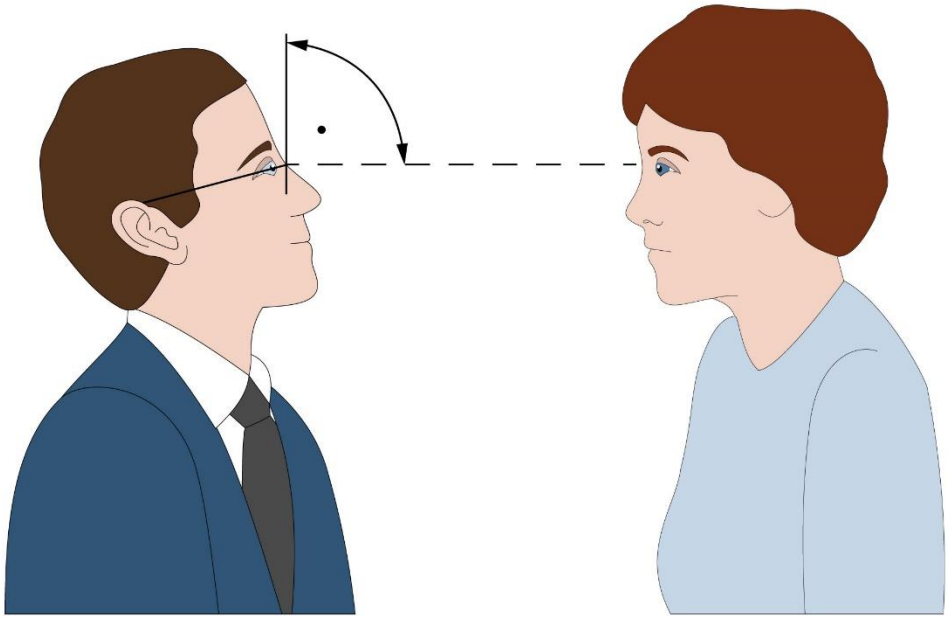
How horizontal decentration limits choice of the spectacle lens diameter?

If we get horizontal decentration as negative number, what does it means?

2 Calculation of spectacle lens vertical decentration

2.1 Introduction

Spectacle lens vertical decentration is important for correct centration of different spectacle lenses. Spectacle lens is correctly centered if the optical axis of this lens goes to real eye's point of rotation, Spectacle frame has 10 degrees pantoscopic angle. For this purpose, we mark position of the pupil if the patient has so called perpendicular view.



Picture 2.1: Usage of the so-called perpendicular view (inspired by Rutrle 2001).

2.2 Goals

- Measure height of the pupil to the bottom of the frame according the boxing system
- Measure height of the eye frame according the boxing system
- Calculate vertical decentration right and left

2.3 Equipment

Spectacle frame, handy or digital PD meter, writing staff, calculator

2.4 Methods

Measure height of the pupil to the bottom of the frame according the boxing system

Put the frame on patient and correctly adapt it. Consequently, adapt the head of the patient to be the frame perpendicular to the floor. Now you can mark position of the pupils of the right and left

eye on demo-foil. Or you can height of the pupil measure right with the handy ruler. Height of the pupil we measure according the boxing system.

Measure height of the eye frame according the boxing system

Draw schematically spectacle frame in protocol and mark and measure all important parameters. For calculation we need the parameter b which means height of the eye frame.

Calculate vertical decentration right and left

With help of bellow presented formula calculate vertical decentration for right and left eye. The parameter y means height of the pupil and parameter b is height of the eye frame.

$$v_{R,L} = y_{R,L} - \frac{b_{R,L}}{2} \qquad \text{[mm]} \qquad (17)$$

2.5 Results

Measure height of the pupil to the bottom of the frame according the boxing system

y_R =

y_L =

Measure height of the eye frame according the boxing system

b =

Calculate vertical decentration right and left

v_R =

v_L =

Drawing of the spectacle frame:

2.6 Discussion

Correct centration is important for correct spectacle lens' imaging. In general, we have to enable condition for so called point imaging. Usually we center aspherical lenses on pupil if the spectacles are adapted on perpendicular view. Centering on pupil in natural view is preferred for anisometropic correction, high refractive index lenses and lenticular lenses.

2.7 Conclusion, notes, comments

How we can know if the frame is suitable for the patient?

What does it mean if the vertical decentration is negative?

How does spectacle frame's pantoscopic angle influence vertical decentration?

3 Spectacle lens vertex distance measurement

3.1 Introduction

Vertex distance is measured from rear side of spectacle lens to front part of the cornea. Vertex distance is important parameter which can change vertex power of the spectacle lens. We have to respect this fact especially in change from spectacle lens to contact lens.

3.2 Goals

Measure vertex distance of spectacle lens in frame with handy PD meter

Measure vertex distance of spectacle lens in frame with special prismatic meter

Measure vertex distance of spectacle lens in frame with centration instrument

3.3 Equipment

Spectacle lens, handy PD ruler or PD meter, writing staff, calculator, centration instrument

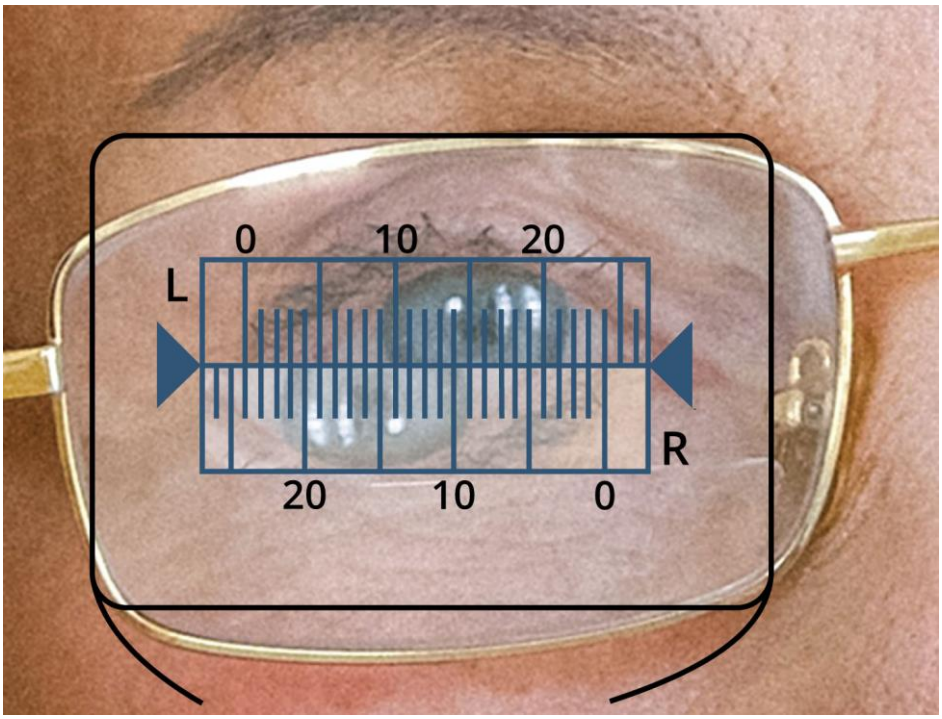
3.4 Methods

Measure vertex distance of spectacle lens in frame with handy PD meter

Put the frame on examined person. With handy PD meter measure distance from back side of the lens to front side of the cornea. You should measure it if the patient looks in infinity with perpendicular view. Fixation axis should go through eye's rotation center and center of the spectacle lens.

Measure vertex distance of spectacle lens in frame with special prismatic meter

Use bellow listed picture and put the prismatic ruler right on the spectacle frame. Put the beginning of the upper part of the scale on limbus and read the value in millimeters from the lower part of the scale. Here you can see deviated image from the same side of the corneal limbus. From the bellow listed picture we can read vertex distance 11 mm.



Picture 3.1: Vertex distance measured with prismatic ruler (inspired by Optiboard 2013)

Measure vertex distance of spectacle lens in frame with centration instrument

Put the centration instrument right on the spectacle frame. On the side of the centration instrument you can find the scale. From this scale you can read the distance from the back side of the spectacle lens to the front part of the cornea.

3.5 Results

Measure vertex distance of spectacle lens in frame with handy PD meter

d_1 =

Measure vertex distance of spectacle lens in frame with special prismatic meter

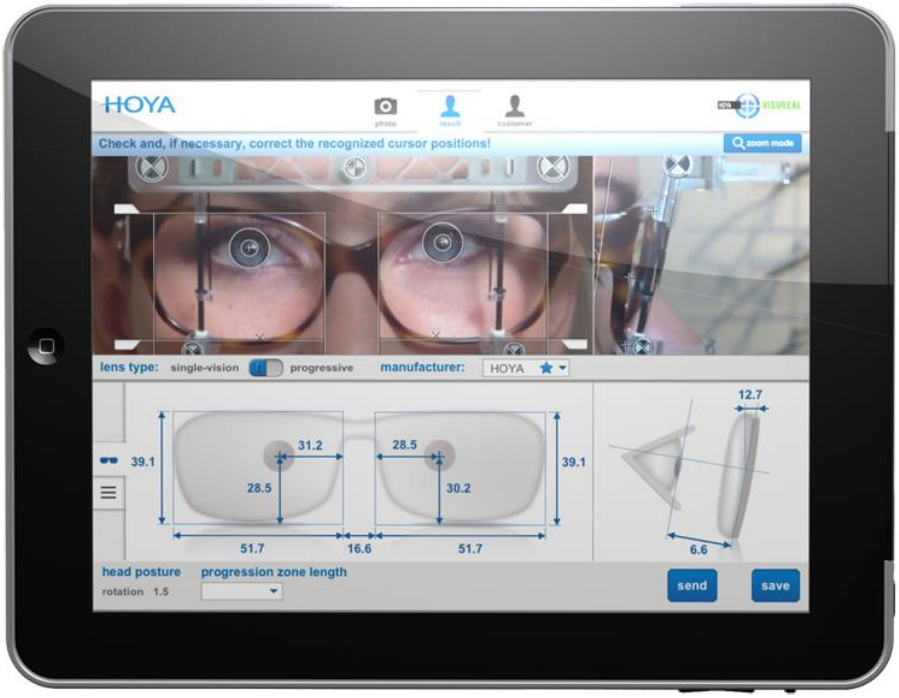
D_2 =

Measure vertex distance of spectacle lens in frame with centration instrument

D_3 =

3.6 Discussion

Currently we can measure vertex distance together with other important centration parameters as is pantoscopic angle, wrap angle, spectacle frame size etc. with help of digital video centration system. These centration systems contain camera and special software. For example, Hoya offer centration system called VisuReal Portable, which can be a part of iPad. Essilor use centration system called Visioffice etc.



Picture 3.2: VisuReal Portable offers by Hoya (Hoya 2013)

3.7 Conclusion, notes, comments

Which one from used technique for measurement of vertex distance is the most exact?

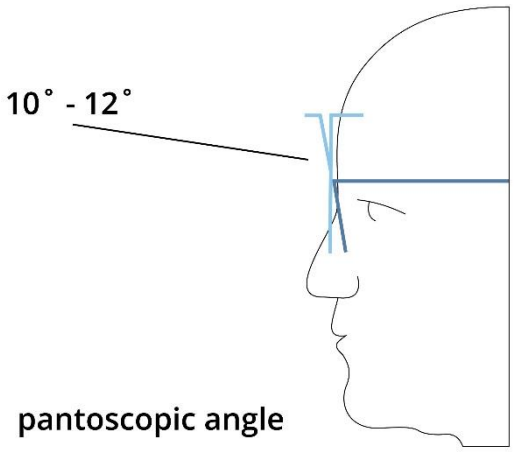
Which one from used techniques for measurement of vertex distance is fastest?

For which purpose is measurement of vertex distance important?

4 Spectacle frame pantoscopic angle measurement

4.1 Introduction

Pantoscopic angle is the important parameter which is used for centration of spectacle lenses. Pantoscopic angle in standard spectacle frame is usually 10 degrees. In this context is very important to centre different spectacle lens with respect to this pantoscopic angle. For example, for traditional progressive lenses is not suitable to choose spectacle frame with zero pantoscopic angle. This spectacle frame has usually doubled side.



Picture 4.1: Pantoscopic angle of the frame (inspired by 2020mag.com 2013)

4.2 Goals

- Measure pantoscopic angle of the spectacle frame with protractor
- Measure pantoscopic angle of the spectacle frame with instrument for measurement of pantoscopic angle
- Calculate vertical decentration of the spectacle lens' optical centre with respect to pantoscopic angle

4.3 Equipment

Spectacle frame, handy PD ruler or PD meter, writing staff, calculator, instrument for measurement of the pantoscopic angle

4.4 Methods

Measure pantoscopic angle of the spectacle frame with protractor

Put the spectacle frame of the patient and adapt it to protect again falling down. With protractor try to measure pantoscopic angle. The pantoscopic angle is angle between general vertical line and

vertical axis of the spectacle frame. Pantoscopic angle is usually from 5 to 15 degrees. If the angle is smaller you can adapt the spectacle frame.

Measure pantoscopic angle of the spectacle frame with instrument for measurement of pantoscopic angle

Let's measure pantoscopic angle with instrument for measurement of pantoscopic angle. This instrument is put on the spectacle frame and with gravity weight you can read pantoscopic angle of the spectacle frame.

Calculate vertical decentration of the spectacle lens' optical centre with respect to pantoscopic angle

$v = (d + 13) * tg\alpha$ [mm], [°] (18)

4.5 Results

Measure pantoscopic angle of the spectacle frame with protractor

α_1 =

Measure pantoscopic angle of the spectacle frame with instrument for measurement of pantoscopic angle

α_2 =

Calculate vertical decentration of the spectacle lens' optical centre with respect to pantoscopic angle

v =

4.6 Discussion

Spectacle lenses should be properly centered if we want to maintain point to point imaging. Proper centration means that spectacle lens' optical axis will goes through real eye's rotation center. We can center lens with respect to so called perpendicular view or we can calculate vertical decentration. For the calculation technique is important vertex distance. Usually 1 degree of pantoscopic angle means 0.5 mm downward in vertical decentration.

4.7 Conclusion, notes, comments

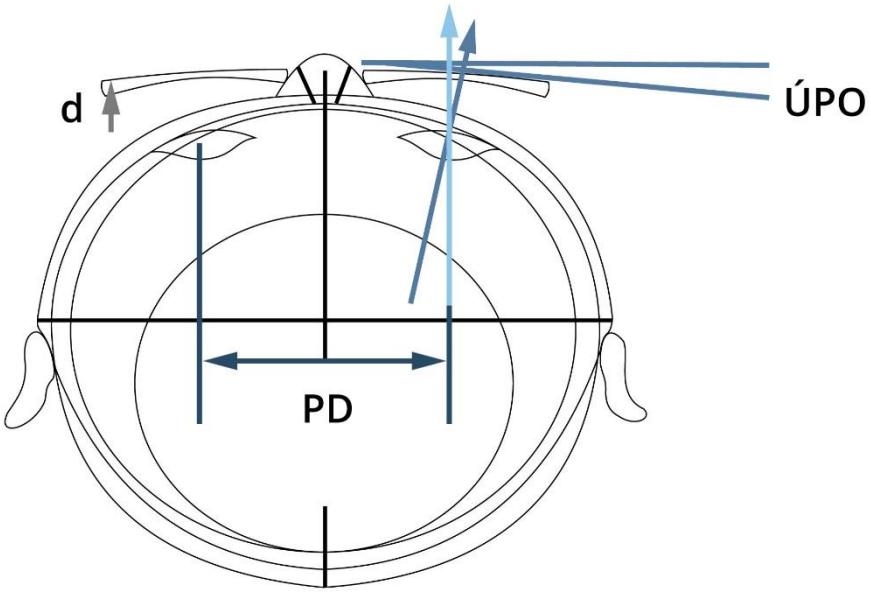
What is the value of pantoscopic angle in your case/example?

What is the approximate value of vertical decentration if the pantoscopic value is 10 degrees? Is there any general rule about the size of vertical decentration?

5 Spectacle frame wrap angle measurement

5.1 Introduction

Wrap angle of the frame has influence on quality of imaging. Picture 5.1. show us wrap angle of the frame. We can see that optical axis is not equal with fixation axis. Individual spectacle lenses enable to compensate astigmatism which is generated by wrap angle of the frame. There is theoretical possibility to decentre spectacle lens' optical center into the temporal side to maintain proper imaging conditions. If we do this peripheral decentration we increase prismatic effect in horizontal direction. In practice manufacturer can apply negative astigmatism power which eliminate astigmatism caused by wrap angle of the spectacle frame (Najman 2010).



Picture 5.1: Wrap angle in spectacle frame (green arrow = axis of the spectacle lens, red arrow = fixation axis) (inspired by Eyesite 2013)

5.2 Goals

- Measure wrap angle of the spectacle frame (γ)
- Calculate theoretical decentration of the spectacle lens

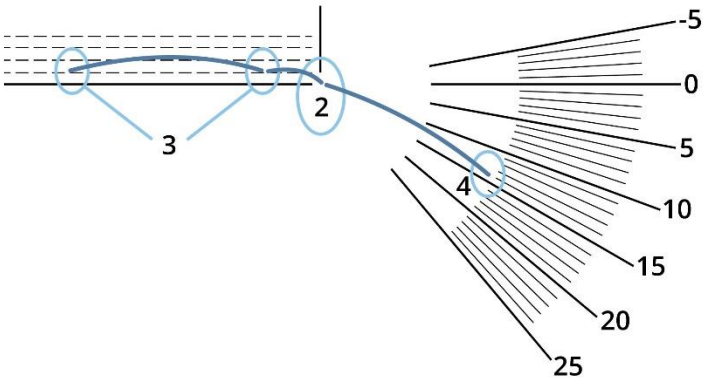
5.3 Equipment

Spectacle frame, handy rule or PD meter, writing staff, calculator, centration template

5.4 Methods

Measure wrap angle of the spectacle frame (γ)

With help of angle meter or centration template measure wrap angle γ according picture 5.2.



Picture 5.2: Measuring of the spectacle wrap (inspired by Pals-n-all 2013)

Calculate theoretical decentration of the spectacle lens

If we want to calculate temporal decentration of the wrapped frame we need to measure vertex distance. This task we can do with handy rule for example. If we know wrap angle and vertex distance we can calculate temporal decentration of the spectacle lens.

$$h_T = d + 13 * tg\frac{\gamma}{2} \quad \text{[mm], [°]} \qquad (19)$$

5.5 Results

Measure wrap angle of the spectacle frame (γ)

Schematically draw shape and wrap angle of the spectacle frame into the protocol. Describe size of the wrapping.

γ =

Calculate theoretical decentration of the spectacle lens

h_T =

5.6 Discussion

So called spectacle frame's wrap angle is important parameter for manufacturing of the individual spectacle lens. These lenses are manufactured exactly according parameters of the customer's frame. It is also important in spectacles for sport to adapt spectacle's lens optical center.

5.7 Conclusion, notes, comments

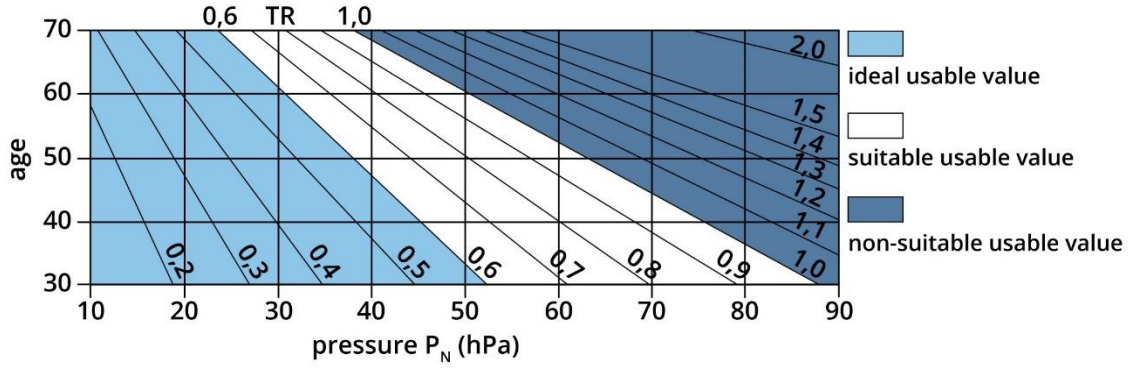
Why we use in calculation formula only half of the wrap angle?

Which methods you can use for measurement of the wrap angle?

6 Spectacle frame pressure relation measurement

6.1 Introduction

Places where is contact between spectacle frame and skin are called “critical places”. Spectacle frame material negatively influences tissue metabolism. Secondary spectacle lens material is influenced by tissue emission substances. Main goal for the optometrist is to choose that combination of spectacle frame material and individual skin type which will be minimally destructive for each other. Empirical data show that accepted skin local stress should be 0.6 till 1 N/cm^2. The weight of the spectacle is divided into nasal part (90 % of total spectacle weight) and into spectacle side part (10 % of total spectacle weight). Picture 6.1 shows ideal values of pressure relation (PR) and of pressure (P_N) according to Fischbach (Rutrle, 2001).



Picture 6.1.: Ideal pressure relation values according to Fischbach (inspired by Rutrle, 2001).

6.2 Goals

- Calculate pressure relation for selected spectacle frame used for 60 years old patient
- Calculate pressure relation for selected spectacle frame used for your age

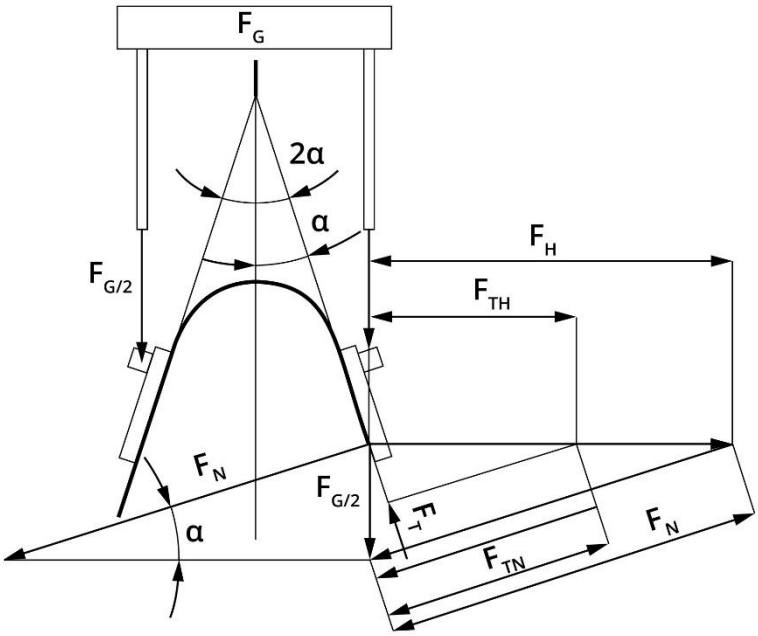
6.3 Equipment

Spectacle frame, digital kitchen scale, writing equipment, angle meter.

6.4 Methods

Calculate pressure relation for selected spectacle frame used for 60 years old patient

For pressure relation calculation we have to measure and calculate some other spectacle parameters. Firstly, measure angle α (see picture 6.2) which is important for calculation of power F_N (see formula 20). With this power press nasal spectacle pads in nasal area. In case of spectacle frame without spectacle lenses add weight 30 grams to weight of spectacle frame.

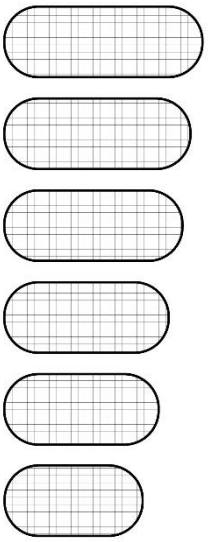


Picture 6.2: List of powers in nasal area (F_G – gravity power, α – angle between line of pad and vertical level, F_H – horizontal power, F_N – normal power, F_{TH} – horizontal friction power, F_T – friction power, F_{TN} – normal friction power; inspired by Rutrle, 2001).

$$F_N = \frac{m*g}{2*sin\alpha} \qquad \text{m [g], } \alpha \text{ [°], g [m.s}^{-2}\text{], } F_N \text{ [cN]} \qquad (20)$$

Note: We use spectacle weight in grams, g means adapted gravity constant 0.981 m.s^{-2} and resulted power F_N is calculated in cN.

After that we can calculate normal pressure P_N. For this calculation we need to know size of spectacle pad area. For this measurement we can use millimeter paper (see picture 6.3)



Picture 6.3: Fischbach's spectacle frame pad patterns (inspired by Rutrle, 2001).

Further we can according bellow listed formula (21) calculate normal pressure P_N. If we use 0.981 for value g and cm^2 for spectacle pad area, we will get result in hectopascals (hPa).

$$P_N = \frac{F_N}{S} \qquad P_N \text{ [hPa]}, S \text{ [cm}^{-2}\text{]} \qquad (21)$$

If we have normal pressure P_N value, we can calculate pressure relation (PR). PR means ration between normal pressure and maximal pressure as a function of the age.

$$TR = \frac{P_N}{1{,}25*(100-age)} \qquad P_N \text{ [hPa]}, \text{ age [years]} \qquad (22)$$

Calculate pressure relation for selected spectacle frame used for your age

We can use the same calculation for PR as in example above.

6.5 Results

Calculate pressure relation for selected spectacle frame used for 60 years old patient

PR_{60} =

Draw shape of the nasal part of the frame and mark the angle alfa and its size.

Calculate pressure relation for selected spectacle frame used for your age

PR =

6.6 Discussion

If we get PR lower than 0.6 it means that spectacles can be worn without restriction. If the PR is lower than 1.0 spectacles can be used in case that patient's skin is healthy. Spectacle sides should be perfectly adapted. If the PR is higher than 1.0 spectacles should be used only for restricted time.

6.7 Conclusion, notes, comments

Which parameters of the spectacle frame should be adapted/changed for better PR?

7 Spectacle frame static relationship measurement

7.1 Introduction

Spectacle frame should press with attached power to the head optimally. Side parts of the frame generate significant power moment at the frame hinge. This power moment increases with length of the spectacle side and initial power. This power works in opposite direction in comparison to attached power of the spectacle side (Rutrle, 2001).

7.2 Goals

- Calculate power which is induced on melted hinge of the spectacle frame
- Calculate power which is induced on rivet hinge of the spectacle frame

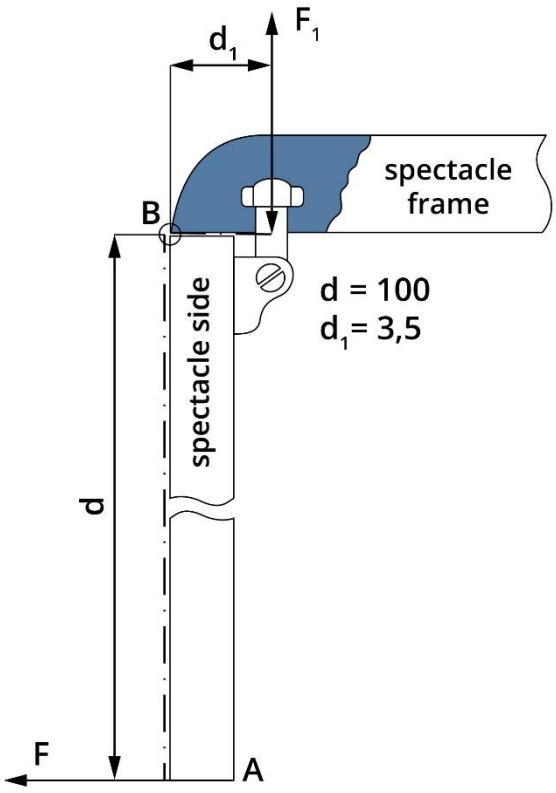
7.3 Equipment

Spectacle frame, handy PD meter, writing equipment, calculator.

7.4 Methods

Calculate power which is induced on melted hinge of the spectacle frame

According to bellow listed picture (7.1) measure length of the spectacle side do the side curvature and distance from the hinge to the edge point B (d_1)



Picture 7.1: Power relationships in melt hinge (F – power, B – edge point, d – distance to the edge point, A – place of power F affection; inspired by Rutrle, 2001).

For our calculation we will suppose that power F affecting with spectacle side curvature the skin behind the ear has 1 N. Further we can calculate according to below listed formula value of the power F_{1Z} which affect the place of melted hinge.

$$F_{1Z} = \frac{F*d}{d_1} \qquad F_{1Z}, F\ [N], d\ [mm] \qquad (23)$$

Calculate power which is induced on rivet hinge of the spectacle frame

With similar way calculate value of the power F_{1N}. This power will affect the spectacle frame in place of rivet hinge. For calculation use below listed formula.

$$F_{1N} = \frac{F*d}{2*d1} \qquad F_{1N}, F\ [N], d\ [mm] \qquad (24)$$

7.5 Results

Calculate power which is induced on melted hinge of the spectacle frame

F_{1Z} =

Calculate power which is induced on rivet hinge of the spectacle frame

F_{1N} =

7.6 Discussion

Pressure of the spectacle sides on spectacle frame hinge is possible to decrease with choosing of wider spectacle frame, widen of the spectacle sides or with increasing of spectacle sides curvature. But on the other hand small pressure of the spectacle sides is recommended otherwise spectacle should have bad stability.

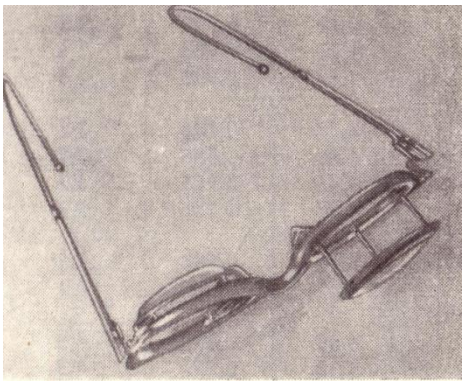
7.7 Conclusion, notes, comments

Which power F_1 is higher. In rivet hinge or in melted hinge?

8 Aniseikonia correction with spectacle frame adaptation

8.1 Introduction

If the patient has aniseikonia we can reduce it with spectacle lens shift according to below listed formula. So, called anisodistance spectacles is possible to use in case of monocular aphakia after cataract surgery. Currently anisometropia, respectively aniseikonia after cataract surgery is successfully solved by intraocular lenses.



Picture 8.1: Anisodistance glasses (Polasek, 1974).

$\beta = 1 - \Delta d . S'_B$ S´ʙ [D], d [mm] (25)

In case we decrease vertex distance in convex lenses we decrease the size of the retinal image. In case of concave lens is it opposite, i.e. decrease of vertex distance means increase of the size of the retinal image. This principal we can use for example with contact lens correction (Rutrle, 1993).

Size of the aniseikonia can be measured by so called eikonometers. Almost all projection or LCD optotypes contains so called hook test which can show size of the aniseikonia and further we can calculate change of the spectacle lens position to minimize aniseikonia.

8.2 Goals

- Calculate sagittal position change of the spectacle lens in given magnification
- Calculate change of magnification by change from spectacle lens to contact lens

8.3 Equipment

Spectacle frame, writing equipment, handy millimeter ruler or PD meter, calculator.

8.4 Methods

Calculate sagittal position change of the spectacle lens in given magnification

Measure given spectacle lens. We need the increase of magnification by 3 %. How many millimeters should we change and which direction to have aniseikonia spectacles?

Calculate change of magnification by change from spectacle lens to contact lens

Given spectacle lens we would like to change for contact lens. How much will change size of retinal image with this correction?

8.5 Results

Calculate sagittal position change of the spectacle lens in given magnification

$\Delta d =$

Calculate change of magnification by change from spectacle lens to contact lens

$\beta =$

8.6 Discussion

We have to parameters which influence aniseikonia. One is own magnification of the spectacle lens and second one is position of the spectacle lens in front of the eye. If we multiply these two parameters we will get total magnification of the lens. This magnification we can use for elimination of aniseikonia. If we have percentage value we have to count two parameters together. Unfortunately for minimalization of the aniseikonia we have only lower potential, i.e. only 5-10 %.

8.7 Conclusion, notes, comments

Which type of eikonometers do you know?

What is the size of the aniseikonia by monocular aphakia corrected with spectacle lens?

What is the size of the aniseikonia by monocular aphakia corrected with contact lens?

9 Taxation of the prescription for spectacles and optical aid

9.1 Introduction

Prescription for spectacle prescribe ophthalmologist in Czech Republic. This document contains information nor only about corrective aid but also about patient and finally about the ophthalmologist. If you get this document in optical store firstly you have to check if it contains all important content. If not, ophthalmologist have to repair it. Below listed picture shows all important contents of the spectacle prescription on its front side. On the back side we have to check if the patient got this for the first time or repeatably and patient's signature. Since 2019 in Czech Republic will get spectacle prescription only children (below 14 years) or patient with special correction (above 10 D, prism correction etc.)

Picture 9.1: Content of the spectacle prescription – front side (inspired by Benes et al., 2010).

Health insurance payment is given by the actual book emitted by General health insurance (VZP). For correct payment there is need to know actual version of this book. It is recommended for every optician and optometrist to have actual version of the book. You can download it from these websites: www.vzp.cz, www.scoo.cz. Below we put sample of actual version of the book for spectacle aid.

Příspěvky zdravotní pojišťovny na korekční pomůcky oční optiky od 1. 9. 2019 - CELÉ POMŮCKY (Tabulka SČOO)

věkové omezení	položka	indikační omezení	počet za období	úhrada ZP	cena za:	kód
DĚTI DO 5 LET VČETNĚ	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ TVRZENÉ,SFÉRICKÉ)		1ks/rok	600,30 Kč	ks	4200001
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ TVRZENÉ,TORICKÉ)		3ks/rok	900,45 Kč	ks	4200002
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ TVRZENÉ,KOMBINACE SF a TORA)		1ks/rok	750,38 Kč	ks	4200048
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,SFÉRICKÉ)	nad +/- 3,0 dpt	3ks/rok	800,40 Kč	ks	4200011
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,TORICKÉ)	nad +/- 3,0 dpt	2ks/rok	1 000,50 Kč	ks	4200013
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,KOMBINACE SF a TORA)	nad +/- 3,0 dpt	2ks/rok	900,45 Kč	ks	4200049
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PRIZMATICKÉ)	diplopie, strabismus	3ks/rok	1 799,75 Kč	ks	4200008
	ÚPRAVA - VRSTVY ABSORBČNÍ NA BRÝLOVÉ ČOČKY	afakie; pseudoafakie; choroby a vady provázené světloplachostí	3 páry/rok	149,50 Kč	pár	4200027
	ÚPRAVA - FOLIE PRIZMATICKÁ	diplopie; strabismus	3ks/rok	519,80 Kč	ks	4200024
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ VYSOKOINDEXOVÉ)	myopie nad -10 Dpt; poruchy CZP; SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	3ks/rok	2 300,00 Kč	ks	4200006
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ BIFOKÁLNÍ)	snížená možnost výměny brýlí; strabismus; afakie	1ks/rok	1 500,75 Kč	ks	4200010
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,HYPEROKULÁRNÍ)	SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	2ks/rok	2 300,00 Kč	ks	4200015
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ LENTIKULÁRNÍ)	nad +- 10 Dpt; afakie	3ks/rok	1 300,65 Kč	ks	4200004
	ČOČKA KONTAKTNÍ MĚKKÁ OKLUZNÍ	amblyopie, intolerance náplastového okluzoru	1 sada/rok	979,80 Kč	zada	4200040
DĚTI 6 -14 LET VČETNĚ	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ TVRZENÉ, TORICKÉ)		1ks/rok	900,45 Kč	ks	4200003
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,SFÉRICKÉ)	nad +/- 3,0 dpt	1ks/rok	800,40 Kč	ks	4200012
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,TORICKÉ)	nad +/- 3,0 dpt	1ks/rok	1 000,50 Kč	ks	4200014
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,KOMBINACE SF a TORA)	nad +/- 3,0 dpt	1ks/rok	900,45 Kč	ks	4200050
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PRIZMATICKÉ)	diplopie, strabismus	1ks/rok	1 799,75 Kč	ks	4200009
	ÚPRAVA - FOLIE PRIZMATICKÁ	diplopie; strabismus	2ks/rok	519,80 Kč	ks	4200025
	ÚPRAVA - VRSTVY ABSORBČNÍ NA BRÝLOVÉ ČOČKY	afakie; pseudoafakie; choroby a vady provázené světloplachostí	1 pár/rok	149,50 Kč	pár	4200028
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ VYSOKOINDEXOVÉ)	myopie nad -10 Dpt; poruchy CZP; SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	1ks/rok	2 300,00 Kč	ks	4200007
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ BIFOKÁLNÍ)	snížená možnost výměny brýlí; strabismus; afakie	1ks/rok	1 500,75 Kč	ks	4200010
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,HYPEROKULÁRNÍ)	SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	1ks/rok	2 300,00 Kč	ks	4200016
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ TVRZENÉ, KOMBINACE SF A TÓRA)		1ks/rok	600,30 Kč	ks	4200052
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ LENTIKULÁRNÍ)	nad +/- 10,0 dpt	1ks/rok	1 300,65 Kč	ks	4200005
OD 15 LET VČETNĚ	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PRIZMATICKÉ)	diplopie, strabismus	1ks/3 roky	1 499,60 Kč	ks	4200019
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,TORICKÉ)	nad +/- 10,0 dpt	1ks/3 roky	700,35 Kč	ks	4200020
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ LENTIKULÁRNÍ)	nad +/- 10,0 dpt	1ks/3 roky	1 036,00 Kč	ks	4200017
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ VYSOKOINDEXOVÉ)	myopie nad -10 Dpt; poruchy CZP; SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	1ks/3 roky	1 999,75 Kč	ks	4200018
	ÚPRAVA - FOLIE PRIZMATICKÁ	diplopie; strabismus	1ks/3 roky	519,80 Kč	ks	4200026
BEZ OMEZENÍ VĚKU	ČOČKA KONTAKTNÍ MĚKKÁ SFÉRICKÁ-STANDARDNÍ PARAMETRY-MĚSÍČNÍ	anisometropie 3 dpt a více; refrakce nad +- 10 dpt	12ks/rok	116,83 Kč	ks	4200034
	ČOČKA KONTAKTNÍ MĚKKÁ SFÉRICKÁ-STANDARDNÍ PARAMETRY-ŠESTIMĚSÍČNÍ	anisometropie 3 dpt a více; refrakce nad +- 10 dpt	2ks/rok	700,35 Kč	ks	4200035
	ČOČKA KONTAKTNÍ MĚKKÁ TORICKÁ-STANDARDNÍ PARAMETRY-MĚSÍČNÍ	refrakce nad +- 10 dpt, astigmatismus do 2,75 dpt cyl., anisometropie 3 dpt a více	12ks/rok	166,65 Kč	ks	4200037
	ČOČKA KONTAKTNÍ MĚKKÁ TORICKÁ-STANDARDNÍ PARAMETRY-ŠESTIMĚSÍČNÍ	refrakce nad +- 10 dpt, astigmatismus do 2,75 dpt cyl., anisometropie 3 dpt a více	2ks/rok	999,93 Kč	ks	4200038
	ČOČKA KONTAKTNÍ MĚKKÁ SFÉRICKÁ-NESTANDARDNÍ PARAMETRY-ŠESTIMĚSÍČNÍ	abnormální velikost rohovky; anisometropie 3 dpt a více; refrakce nad +- 10 dpt	2ks/rok	999,93 Kč	ks	4200036
	ČOČKA KONTAKTNÍ MĚKKÁ TORICKÁ-NESTANDARDNÍ PARAMETRY-ŠESTIMĚSÍČNÍ	refrakce nad +- 10 dpt, astigmatismus od 3,00 dpt cyl.; anisometropie 3 dpt a více	2ks/rok	1 749,73 Kč	ks	4200039
DĚTI 15 - 17 LET VČETNĚ	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,HYPEROKULÁRNÍ)	SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	2ks/rok	1 999,85 Kč	ks	4200021
	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ BIFOKÁLNÍ)	snížená možnost výměny brýlí; strabismus; afakie	1ks/rok	1 200,60 Kč	ks	4200023
OD 18 LET	BRÝLE DIOPTRICKÉ (OBRUBA+ČOČKY BRÝLOVÉ PLASTOVÉ,HYPEROKULÁRNÍ)	SCHVÁLENÍ REVIZNÍM LÉKAŘEM!	1ks/3 roky	1 999,85 Kč	ks	4200022

Picture 9.2: Book for payment from VZP actual from 2019 (Benes et al., 2010).

9.2 Goals

- In protocol according, the up listed sample draw and fill prescription for spectacles with all content.
- Fill in prices for spectacles and lenses according up listed prescription.

9.3 Equipment

Actual price book of General health insurance (VZP), writing equipment, calculation.

9.4 Methods

In protocol according, the up listed sample draw and fill prescription for spectacles with all content.

Draw and fill both sides of the prescription in protocol. Firstly, fill patients name and surname, further ophthalmologist's data. You can define type of refractive error. It is recommended to use noncommon refractive values. Finally fill in if the patient will get payment for hard coat, tinting and on the other side of the prescription fill in date of the last corrective aid.

Fill in prices for spectacles and lenses according up listed prescription.

Fill in values for optical aid according actual VZP book including its codes. Use the rule of the cheapest payment.

9.5 Results

In protocol according, the up listed sample draw and fill prescription for spectacles with all content.

Fill in prices for spectacles and lenses according up listed prescription.

9.6 Discussion

Prescriptions are sent by optical store to VZP and other private insurances once a month. If the officer found that something is missing in the prescription it is send back to optical store. Expiration date of the prescription is 3 months.

9.7 Conclusion, notes, comments

How often will get money for spectacle frame 2 years old children?

What is the payment for spectacle aid for adult with prescription: OD: sph -10.25D cyl -2.0D ax. 135deg. OS: sph -11.25D cyl -1.0D ax. 45deg.?

What optical aid should get adult with refraction error higher than 10 D?

10 Choice and recommendation of spherical/cylindrical single vision lens from the catalogue

10.1 Introduction

Proper choice of spectacle lens is very important task in practice of optician and optometrist. We have to evaluate not only technical view but also economic and aesthetic parameters of the spectacle correction. We have strict rules for centration of spherical and sphero-cylindrical lens. If we have isometropic patient we have to respect real center of eye rotation, i.e. that optical axis of the spectacle lens goes through real center of eye rotation. Correct centration is done if the optical center of the spectacle lens is moved to point of optical centration. This point is created in place where fixation axis crosses level of the spectacle frame if the frame is in perpendicular position in comparison to the general level of the ground. In case of anisometropic correction and in near correction with this so called "point imaging" is created vertical and horizontal prismatic effect which can negatively influence patient's fusion reserves. Mainly vertical fusion reserve and critical vertical effect is very low.

10.2 Goals

- For given spectacle frame choose and center proper spherical or sphero-cylindrical lens from lens catalogue.
- For given patient release and evaluate prescription for optical aid.
- For given patient and prescription create financial plan for spectacles.

10.3 Equipment

Actual book of VZP, catalogue of spectacle lens producer, writing equipment, calculator, PD meter.

10.4 Methods

For given spectacle frame choose and center proper spherical or sphere-cylindrical lens from lens catalogue.

Your task is to choose proper spectacle frame for you colleague (student) from spectacle book and proper spectacle lens. Correction could be for distance or near vision. In the protocol you should note all measured parameters and data of selection including boxing system, PD of the patient, height of the centration, vertex distance, name of the frame and lens, type of antireflection coating. You should of course calculate and note decentration and chosen lens diameter.

For given patient release and evaluate prescription for optical aid.

You should draw general prescription form into the protocol and fill in all important notes in it. Further you should financially evaluate the prescription.

For given patient and prescription create financial plan for spectacles.

In this task you should create financial evaluation of the prescription for patient, i.e. you will sum price for the spectacle frame, spectacle lenses, for addition task as e.g. repair of the side, soldering etc. is. From this sum you will subtract price for the prescription and define payment for advance and payment of the rest of the issue.

10.5 Results

For given spectacle frame choose and center proper spherical or sphere-cylindrical lens from lens catalogue.

For given patient release and evaluate prescription for optical aid.

For given patient and prescription create financial plan for spectacles.

10.6 Discussion

We have many types of spherical or sphere-cylindrical lenses on the market from different material. There are many spectacle lens producers and distributors on Czech market. Offer of these producers we can find in product catalogues. There is a need to orient yourselves in offer of the producers. You should be able to choose proper product which will be adequate to client's needs.

10.7 Conclusion, notes, comments

Which producers with spectacle lens offer is according to your opinion the best on the market and why?

What criteria did you evaluate during the choose of the spectacle frame?

11 Choice and recommendation of bifocal lens from the catalogue

11.1 Introduction

Bifocal lenses are still currently alternative solution to progressive lenses. Bifocal lenses have some advantages which are preferred by some patients. Bifocal lenses have lower peripheral astigmatism and distortion in comparison with progressive lenses. Main disadvantage of the bifocal lens is skip of the image and aesthetic problem which is represented by visible connection between distance and near part of the lens.

11.2 Goals

- For given spectacle frame choose and center proper bifocal lens from lens catalogue.
- For given patient release and evaluate prescription for optical aid.
- For given patient and prescription create financial plan for spectacles.

11.3 Equipment

Actual book of VZP, catalogue of spectacle lens producer, writing equipment, calculator, PD meter.

11.4 Methods

For given spectacle frame choose and center proper bifocal lens from lens catalogue.

Your task is to choose proper spectacle frame for you colleague (student) from spectacle book and proper spectacle lens. Correction could be for bifocal lenses. In the protocol you should note all measured parameters and data of selection including boxing system, PD of the patient, height of the centration, vertex distance, name of the frame and lens, type of antireflection coating. You should of course calculate and note decentration and chosen lens diameter.

For given patient release and evaluate prescription for optical aid.

You should draw general prescription form into the protocol and fill in all important notes in it. Further you should financially evaluate the prescription.

For given patient and prescription create financial plan for spectacles.

In this task you should create financial evaluation of the prescription for patient, i.e. you will sum price for the spectacle frame, spectacle lenses, for addition task as e.g. repair of the side, soldering etc. is. From this sum you will subtract price for the prescription and define payment for advance and payment of the rest of the issue.

11.5 Results

For given spectacle frame choose and center proper bifocal lens from lens catalogue.

For given patient release and evaluate prescription for optical aid.

For given patient and prescription create financial plan for spectacles.

11.6 Discussion

In ideal example addition of the bifocal lens should be lower than accommodation amplitude. In this case patient is able to cover with accommodation interval all distance and there is no blurry part of visual field. On opposite case (addition is higher than accommodation amplitude) patient will see blurry parts of visual field. This problem is successfully solved by progressive lenses. But progressive lenses contain progressive corridor with peripheral blurry parts and distortion which patient have to adapt on it.

11.7 Conclusion, notes, comments

Which types of bifocal lenses do you know – according to material and technology of manufacturing?

Which types of near segments for bifocal lenses do you know?

Who is inventor of the bifocal lenses?

12 Choice and recommendation of progressive and degressive lens from the catalogue

12.1 Introduction

Conception of the progressive lenses is known since beginning of the 19th century. First progressive spectacle lens was produced thanks to professor Maitenaze from France in the fifties of 20th century. It was the lens with aspherical and side symmetric design. Type of progressive corridor was the same for right and left eye. Next years there were new types of progressive spectacle lenses. Currently many global manufactures are able to produce progressive lens with the so called Free-From technology. Thanks to this technology we can reduce peripheral astigmatism and distortion and if it is needed we can reduce high order aberration. Degressive lenses are special progressive lenses adapted for middle and near distance.

12.2 Goals

- For given spectacle frame choose and center proper progressive or degressive lens from lens catalogue.
- For given patient release and evaluate prescription for optical aid.
- For given patient and prescription create financial plan for spectacles.

12.3 Equipment

Actual book of VZP, catalogue of spectacle lens producer, writing equipment, calculator, PD meter.

12.4 Methods

For given spectacle frame choose and center proper progressive or degressive lens from lens catalogue.

Your task is to choose proper spectacle frame for you colleague (student) from spectacle book and proper spectacle lens. Correction could be for progressive or degressive lens. In the protocol you should note all measured parameters and data of selection including boxing system, PD of the patient, height of the centration, vertex distance, name of the frame and lens, type of antireflection coating. You should of course calculate and note decentration and chosen lens diameter.

For given patient release and evaluate prescription for optical aid.

You should draw general prescription form into the protocol and fill in all important notes in it. Further you should financially evaluate the prescription.

For given patient and prescription create financial plan for spectacles.

In this task you should create financial evaluation of the prescription for patient, i.e. you will sum price for the spectacle frame, spectacle lenses, for addition task as e.g. repair of the side, soldering etc. is. From this sum you will subtract price for the prescription and define payment for advance and payment of the rest of the issue.

12.5 Results

For given spectacle frame choose and center proper progressive or degressive lens from lens catalogue.

For given patient release and evaluate prescription for optical aid.

For given patient and prescription create financial plan for spectacles.

12.6 Discussion

Standard progressive lens is centered according to printed marks. For general centration we need the frame with standard pantoscopic angle and enough size of frame. Currently we can choose 3 basic types of progressive canal length. The shortest progressive canal is 16 mm length, but this canal usually produces highest peripheral astigmatism and distortion.

12.7 Conclusion, notes, comments

Is it possible to center progressive lens without printed marks? How?

We have to types of centration and ordering of degressive lens? Which types?

13 Choice and recommendation of lenticular lens from the catalogue

13.1 Introduction

Lenticular lenses are special spectacle lenses for high ametropia correction. They were used in times when we have no high index lenses. Currently lenticular lenses are replaced by high index lenses. Lenticular lenses are produces from glass or plastic. Optical and none optical zone can be polished or unpolished. The main disadvantage of the lenticular lens is reduction of the patient's visual field and aesthetic conception.

Picture 13.1: Convex lenticular lens (Benes et al., 2010).

13.2 Goals

- For given spectacle frame choose and center proper lenticular lens from lens catalogue.
- For given patient release and evaluate prescription for optical aid.
- For given patient and prescription create financial plan for spectacles.

13.3 Equipment

Actual book of VZP, catalogue of spectacle lens producer, writing equipment, calculator, PD meter.

13.4 Methods

For given spectacle frame choose and center proper lenticular lens from lens catalogue.

Your task is to choose proper spectacle frame for you colleague (student) from spectacle book and proper spectacle lens. Correction could be for lenticular lens. In the protocol you should note all measured parameters and data of selection including boxing system, PD of the patient, height of the centration, vertex distance, name of the frame and lens, type of antireflection coating. You should of course calculate and note decentration and chosen lens diameter.

For given patient release and evaluate prescription for optical aid.

You should draw general prescription form into the protocol and fill in all important notes in it. Further you should financially evaluate the prescription.

For given patient and prescription create financial plan for spectacles.

In this task you should create financial evaluation of the prescription for patient, i.e. you will sum price for the spectacle frame, spectacle lenses, for addition task as e.g. repair of the side, soldering etc. is. From this sum you will subtract price for the prescription and define payment for advance and payment of the rest of the issue.

13.5 Results

For given spectacle frame choose and center proper lenticular lens from lens catalogue.

For given patient release and evaluate prescription for optical aid.

For given patient and prescription create financial plan for spectacles.

13.6 Discussion

If you will grind the shape of the lens with automatic grinding machine you should be careful not to lose the lens holder. Patient should get advice about the reduction of the lenses' visual field. Spherical lenticular lens should be centered on pupil with natural head position. If we center aspheric lenticular lens we have to prefer put the lens cent on pupil in so called perpendicular view.

13.7 Conclusion, notes, comments

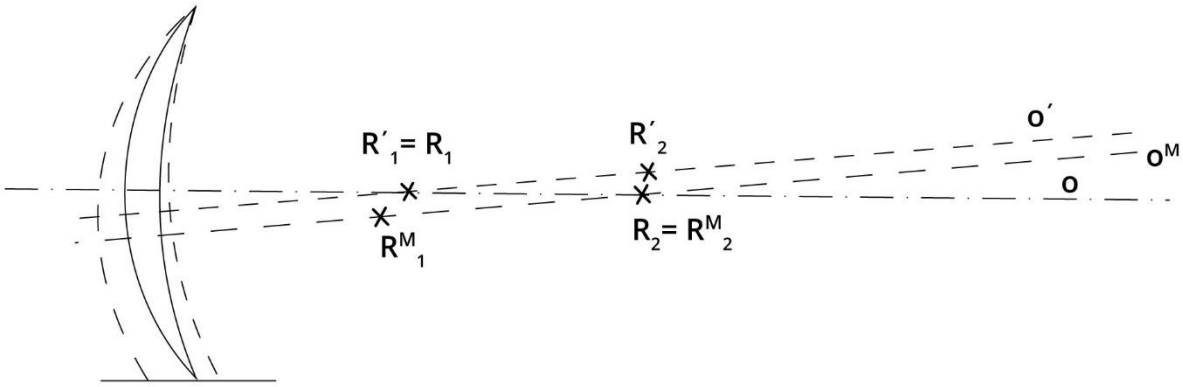
Which types of lenticular lenses you know – material and type?

How does differ the price of lenticular and high index lens for the myopia -11 diopters?

14 Choice and recommendation of prismatic lens from the catalogue

14.1 Introduction

Prism lenses are used for correction strabismus and heterophoria. Prism lenses move the optical ray to base of the prismatic lens, which is thickest part of the lens. Prismatic correction can be realized by two ways. Firstly, we can decenter spherical or sphere-cylindrical lens during the centering and grinding. More exact method is ordering the prismatic effect on given lens which is produced by usage of special grinding ring or tilting of the grinding arm.



Picture 14.1: Manufacturing of prismatic lens (R – center of the curvature, o – optical axis; inspired by Rutrle, 1993).

14.2 Goals

- For given spectacle frame choose and center proper prismatic lens from lens catalogue.
- For given patient release and evaluate prescription for optical aid.
- For given patient and prescription create financial plan for spectacles.

14.3 Equipment

Actual book of VZP, catalogue of spectacle lens producer, writing equipment, calculator, PD meter.

14.4 Methods

For given spectacle frame choose and center proper prismatic lens from lens catalogue.

Your task is to choose proper spectacle frame for you colleague (student) from spectacle book and proper spectacle lens. Correction could be for prismatic lens. In the protocol you should note all measured parameters and data of selection including boxing system, PD of the patient, height of the centration, vertex distance, name of the frame and lens, type of antireflection coating. You should of course calculate and note decentration and chosen lens diameter.

For given patient release and evaluate prescription for optical aid.

You should draw general prescription form into the protocol and fill in all important notes in it. Further you should financially evaluate the prescription.

For given patient and prescription create financial plan for spectacles.

In this task you should create financial evaluation of the prescription for patient, i.e. you will sum price for the spectacle frame, spectacle lenses, for addition task as e.g. repair of the side, soldering etc. is. From this sum you will subtract price for the prescription and define payment for advance and payment of the rest of the issue.

14.5 Results

For given spectacle frame choose and center proper prismatic lens from lens catalogue.

For given patient release and evaluate prescription for optical aid.

For given patient and prescription create financial plan for spectacles.

14.6 Discussion

In case of decentration of spherical or sphere-cylindrical lens for inducing of prism effect we are not able to maintain condition for point imaging. High prism effect we can only induce with strong power lens. High decentration cause different peripheral thickness of the lens which is not aesthetic. Manufactured prismatic lens should be shifted by 0.25 mm per 1 pD against the base of the lens because of maintaining of point imaging.

14.7 Conclusion, notes, comments

We have two types of decentration for prismatic lens. Explain the principal.

Why we do the decentration of the main point of prismatic lens in direction against the base of the lens (0.25 mm per 1 pD)?

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Spectacle technique II

Practical exercises

Mgr. Petr Veselý, DiS., Ph.D.

Department of Optometry and Orthoptics,
Faculty of Medicine, Masaryk University

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