WHAT IF…

The benefits of behavioural optometry

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Fellowship BOAF

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what a piece of work is a man,

how noble in reason,

how infinite in faculties,

in form and moving how express and admirable,

in action how like an angel,

in apprehension how like a god...

WHAT WENT WRONG?

It's Christmas 1971. On the table is my present. It is a square package, wrapped in silver foil. I know what's in it. I bought it myself. Because I knew I would love it forever. It's a book. It's called: The once and future king. This essay is inspired by that book.

A few words about the language of this thesis:

I am Dutch, I speak and read 4 languages. So I did not expect it to be a problem to write this in English. But re-reading it, I saw a weird sort of English. Not English as a matter of fact. For a moment I have considered to re-write it in Dutch and let 'Google translate' to have a go with it. Rejected it almost immediately – the result was far more ridiculous.

So here I offer this in the crooked English that I use. Rather this and my own words than Google's.

And a few words on the motivation for this thesis:

I have been a visual trainer for 30 years or so. And so vividly see the importance of it. And also see the deterioration of learning skills, retrogression in behaviour, met worried parents and despaired teachers.

I have seen so many changes for the good, but only on so few people. I want us to expand. That is why I was there when Stefan started BOAF. In Holland there are different groups of therapists working with children, claiming they perform Visual Training. Most of them have no idea what that is. They don't know about Skeffington and his circles (what a brilliant concept that is...) So I want to teach it to them. As I am a certified teacher (in arts and crafts) it is not too hard for me to do. And I have had so many hours of workshops on VT, I know the trade. I have worked with children and adults, with any visual problem you can think of. Oh yes, I can do that with ease.

There has always been a problem where to fit me in, as I am not an optician or optometrist. And with this essay I want to show you that I can do a fine job for behavioural optometry.

Content

Chapter 1

Narrative: Wart is transformed into a fish, about learning.

First I will commend on a blissful writing about the great training material Tooties. Essential in my office. No session without them. Thea Looijmans wrote it. Working with the Tootie launcher.

Chapter 2

Eindhoven project (the use of Tooties in an online course for teachers and parents that I helped make). Article by Rob Gevers.

Chapter 3

Narrative: Arthur comes up with the idea of the Round Table, it's about the bad quality of men transforming into civilization.

This is followed by the story of a boy (aged 7, I will call him Lucky) who I helped to get back on his feet again (and change his perspective on a troublesome future). He could easily fall in the booby-trap of developing myopia. And worse: juvenile delinquency.

Chapter 4

Myopia article, prosperity countries, Martha Nussbaum.

Chapter 5

Narrative: Badgers tale., about the essence of men.

Next a case of an adolescent (aged 17, I chose to call him Kahmal), who has never seen stereopsis in his life. I can't work without the support and

visual analytical from my friend and behavioural optometrist Henk Rensen. Let's see if and how we got it done.

Chapter 6

Narrative: The candle in the wind, about passing on ideals.

The third part is about a young woman (aged 23 and her name is Beau or Belle). She wore prism glasses ever since her childhood. She got so thrilled about the training that she really wants to become a vision therapist – and she will. In fact she will take over my office.

She co-tells the story.

Chapter 7

Narrative: the refreshed king. About fulfilment and hope.

What do we need?

And of course I will end this essay being thankful for all that I learned from this work. I also will express my sincere hope for the future.

And be delighted.

Chapter 1

The first book of 'the once and future king' is about Wart's (as the future king is called as a boy) education, with Merlin as his tutor. He is being transformed into different animals in order to learn about power. About boundaries. About freedom. Something a future king should know.

"He knew that he was turning into a fish.

'Oh, Merlyn,' he cried, 'please come too.'

'For this once,' said a large and solemn tench beside his ear, 'I will come. But in future you will have to go by yourself. Education is experience, and the essence of experience is self-reliance."

Gregg Gilman said: 'Teach the body and the mind will flourish'.

And good old Einstein said: 'Learning is an experience, anything else is just information'.

That is what VT is about. That is why I use Tooties.

Book review: Learning to learn by Thea van Eijk - Looijmans

Tooties are invented by John Hanson. He reinvented the well-known beanbags that are used in many professions and schools. He attended many lectures by Jerry Getman (How to develop your child's intelligence). He needed to know how children develop and how he could help them become successful in their skills.

This book is about Tooties and how to use them properly. There are a lot of games in it, with pictures. It is highly inspiring for teachers as well as parents.

And yet for me the importance of this writing is the underlying philosophy.

We (mankind) are developed in a natural way. Slowly becoming what we are now. By copying others, children learn. By helping around the house, children learn. By moving around, they learn. They learn in the real world. That is how it used to be. It is not true nowadays, not in our civilized world. Therefore children develop differently. Certain skills needed for school tasks are not learned. Children fail at school. Much to their parents' surprise. The world children are raised in is a world full of devises, of quick stimuli. Everything is there on command. They have far too much toys and of very poor quality too. They watch television for many hours a day and use their smartphone endlessly.

They can't think in solving problems. They can't think creatively.

Tooties are designed to help children learn.

And learn by doing, carrying out plans. Feel how your body works, experience different tensions in legs and arms. Repeat repeat repeat. 'Do it again': John was always – smilingly – saying that.

The main instruction is: do not show how it is done. Do not tell how to do it. Praise everything they do well.

One of the best Tootie device is the launcher. You can very well use it as a diagnostic tool. I use it with everyone in my office: young and old, male or female. And I usually use it in the first series.

I often regret not to have filmed this the first time the clients work with it. And then compare a few months later. It is amazing how the performance has changed.

As an example I introduce Lucky. He will be in chapter 3. The very first visit we did the 'launcher and catch' game. He was enthusiastic. He was doing his very best and failed in catching time and time again. So he started to focus on another possibility: how high will the Tootie go? Can it hit the ceiling? Can it hit it with a bang? He was working hard and became more and more chaotic. He changed the rules, he came up with all sorts of actions and refused to go back to the original instruction. His mother sighed. 'This is how he always is', she said. Yes of course. He showed me how he is. He showed me 'This is me'.

The next time we did this game I gave him a container to catch the Tooties in. He calmed down at once. A few sessions later we did it again. And as soon as I told him that he couldn't use the container anymore, he refused to carry it out. So strong was this feeling of not being able to cope. And along with this, the behaviour: stubborn, angry, withdrawn and so on. It was hard for him to change that. But through all the training activities he managed to. One of the last sessions we did the launcher again: he could easily catch 11! No sweat. He was utterly surprised himself.

John never wrote anything down and had reasons for it. I have attended his teaching sessions about four times and saw him work with clients in Soest (Instituut voor Optologie). And I learned by experiencing it. If I just had read the book I would never have been so impressed as I am now. Nor would I have used them as often as I do now.

So I recommend you to read the book, then call on the Tootie people to ask them to demonstrate and teach you. It will change your life.

Chapter 2

In about 2008 I bought a new set of Tooties. I went to Eindhoven where Thea lives to select the colours. We talked about our vision on raising children, our ideas about education, about the world and the mess it is in, we talked. And gradually I teamed up with her for several parts of the realisation of her dreams: make Tooties more known and further more: have scientific proof that it works. It is a big dream. It is an ambitious plan. She contacted Anna Bosman, professor in education on the Nijmegen Radboud University. She had a few students helping out with observing children using the Tootie launcher. This has been filmed and noted down. Very valuable information.

This ended up in making a course for teachers and parents with children in 1st and 2nd grade: Beter leren door spelen. It would be online. It would include videos. Thea came here to the office to film me answering her questions about visual and developmental issues. We send it to several people, including Stefan Collier. He was thrilled and prepared to collaborate. We had a meeting with Stefan, Anna, Thea and Rob (it is his article I will discuss in this chapter) in Nieuwegein, after a syntonics course. Rob and Stefan discussed what sort of testing would be useful for the research.

Thea visited the school to instruct the teachers twice and I went with her once.

The article 'Beter leren door kijken' written by Rob Gevers (Attachment 1, page 57), explains the followed procedures and the findings.

We were pleased with the results, it proved that it worked. Also the students recorded more progress in several school tasks in the group that had anticipated in the course.

It is always a pity that there are limits in time. There were handicaps too: very few parents attended the course, teachers could not carry out the suggestions all the time, the team got reorganized.

It would have been wonderful if the optometrists could have executed the full OEP testing and tests like ‘angles in the snow’. Also that the school had more accompaniment in the course. So that there would be more inspiration and more thrill in working with it. And then repeat the research. I am curious what that will end up with.

Chapter 3

"And he began talking so quickly that he could hardly keep up with himself.

'You see,' he said, 'Might is not Right. But there is a lot of Might knocking about in this world, and something has to be done about it. It is as if people were half horrible and half nice. Perhaps they are even more than half horrible, and when they are left to themselves they run wild. You get the average baron that we see nowadays, people like Sir Bruce Sans Pitié, who simply go clod-hopping round the country dressed in steel, and doing exactly what they please, for sport. It is our Norman idea about the upper classes having a monopoly of power, without reference to justice. Then the horrible side gets uppermost, and there is thieving and rape and plunder and torture. The people become beasts.'

'But, you see, Merlyn is helping me to win my two battles so that I can stop this. He wants me to put things right.'

[…]

'Now what I have thought,' said Arthur, 'is this. Why can't you harness Might so that it works for Right? I know it sounds nonsense, but, I mean, you can't just say there is no such thing. The Might is there, in the bad half of people, and you can't neglect it. You can't cut it out, but you might be able to direct it, if you see what I mean, so that it was useful instead of bad.'"

This is about the plan of the Round Table, to bring civilization in his kingdom. By stimulating the wild and untamed people, to turn into noble men.

This is Lucky's story. I call him Lucky because he is. He does not know it and maybe he never will, but I know. Oh sure yes I know.

I need to explain how I work first, because it's a-typical. The following will give you an idea.

It is spring 2014. Lucky is in the third grade (in Holland the children start kindergarten at the age of four, and that is called the first grade). He is not doing well. The teacher thinks that he has ADHD. His mother knows about behavioural optometry as she had VT in my office as a child. So she calls me. I advise her to go and see Henk (www.optologie.nl) who is the owner of the Optologisch Centrum Purmerend. He will make a full investigation in the OEP tradition. Once

that is done, he will send the data to me (we share the same FileMakerPro program) and we will discuss the plan that he has for Lucky. He also sends a written report to the parents.

The results of the analysis are found in the attachment right after this chapter on page 18.

Notes on the conversation with Henk:

'This is a very immature system. Start on a very low level. His locomotion is all right, his body scheme is not. Visual organisation at near is very poor. He needs plus for near.'

Lucky is the eldest of three boys – that is a fact that partly caused his behaviour. He lost his unique position as an only child, with all the attention that went along with it. The parents were both working.

Quote: Action without vision is a nightmare

Vision without action is a daydream

The first line applied to Lucky.

I invited both parents to the office in order to clarify what has been found and what the plans are. What is expected of them and Lucky. There is plenty of time to answer questions and to express hopes and fears. A money talk is also needed as we are not compensated by insurance companies.

The plan:

Lucky will double third grade.

Lucky will wear his prescription glasses for tasks at near.

We will start syntonics after summer break.

We will start VT as soon as possible. Scheduled for once in a week.

Lucky will visit the office every week till summer holidays. His homework will consist of three exercises, performed with the parent who is attending the sessions here. This is VT home. As I work a full hour of

60 minutes, there will be time left for learning in a certain way (see chapter 1: Tooties) which is called in office. The parent will be there too, there is a lot to learn for them.

First the emphasis will be on lateralisation, body scheme and reducing reflexes.

Session	In office	VT home
1	Tootie launcher, catch	Jumping jacks, also crossed Marsden ball push. Angels in the snow, standing
2	Tootie launcer, catch in bowl	Body roll Clap and pound Marsden ball pursuits, lying down
3	We needed a good talk	Angels in the snow lying Body code 1 Jump in and out of the square
4	Discuss the vacation plan	Balance board and watch TV Body code 2 Shred paper and fumble
5	Wayne saccadic fixator 3	3 hop Octopus and caterpillar Tel me what you see and I draw that

During the 6 weeks of vacation Lucky will repeat the exercises (except the time they are holidaying with the family). The end of August we start syntonics.

Copies of the campimetry in the five weeks he did the syntonics, are added in the attachments.

Session	In office	VT home
6	Campimetry Instruction on the use of the colorboy	Syntonics alpha omega/ mu delta 4 minutes each
7	Campimetry Tootie launcher & catch	Syntonics up to 8 minutes Marsden ball and VMT bat

I did not give him much extra homework, as syntonics can be rather hard to carry through for a child like this. The parents created a special moment for him: the two brothers went to bed and mum and dad took a

full hour to be with him. They read to him while he's looking into the light. He enjoyed this very much.

I made an appointment with his teacher to visit school and explain what we are doing.

After the five weeks of syntonics therapy Lucky will be in the office once a fortnight. I now will be working on binocularity and sensory/motor integration.

Session	In office	VT home
8	Trampoline with numbers and hand movements	Vecto BI and BO till break ten recover Wiener crawl Visualisation maze
9	Vectograms for silo	Marsden ball + VMT bat, hands in the middle Tell me where it is (same direction) Body code 3
10	Vectograms	Brock string Optomatters OPT CC1 and CC3 Finish the drawing mirrored

Lucky is going to see Henk.

Henk's commend: he is doing really well, especially amplitude. We need to do a lot of exercises for spatial awareness. Stereopsis is better. He starts to move to exo nearby. Take care: he starts to compensate with his central system.

The teacher visits the office to see what it is like here and to hear the results of Lucky's visit to Henk.

Lucky can be very angry at school and at home. He doesn't know why. I give some advice: 'keep a close watch on him'. Observe what he is doing. There is always interaction with the other kids. He doesn't understand what is happening. He does not know his part in the situation. He does not know why you are angry. You need to be his eyes until he can use them for himself. Ask him what he is afraid of. Also act more as our forefathers the monkeys do: pull the child to you in case of danger and push the child away if it irritates you. On this level of development you

need to be much closer to the child and less verbally correcting him. Parents use their voice to cross over space, as a remote control. And then say: 'he does not listen.' There needs to be far more proximity when you raise a child. And preferable: not on your own but in the entire community. It takes a village to raise a child.

One of the things Lucky cried about was that the training sessions were no longer as they were when he was doing syntonics: a full hour with mom and dad! That was easily fixed!

Session	In office	VT home
11	Wayne saccadic 6	Walk the line (maze) and tell left or right 0I0 BO Encircle 1 to 20
12	Kraskin prisms red/green	Large fusion circles Balance (aeroplane) Zoo vecto BI and BO
13	Tootie launcher catch	Moro reduction Balance board, fixate and move head Alternate small and big fusion circles
14	Wachs blocks	0I0 transparent BI Throw Tootie under leg and catch Wachs spirals between lines

Lucky has changed moods. I decide to do some syntonics again for two weeks and also start working with the parents on how they can coach him to diminish his impulsiveness: he needs to put into words what goes on in his mind before he starts doing or taking things. Therefore he needs to visualize. He also needs to do chores in the house that work on visualisation.

Session	In office	VT home
15	Campimetry Trampoline	Syntonics omega N/ mu delta
16	Tootie toss Biopter booklet BO	Omega N/ mu delta Moro reduction

Lucky is doing far better at school now. I gave him the golden glasses (as he calls it) syntonics filter S. For more space and to reduce eso. Lucky is

thrilled: his father also has golden glasses. He is a mountain biker. Lucky starts to write terribly small. He gets lined paper to use.

The last part of VT emphasizes visualisation and communication as is mentioned before.

Session	In office	VT home
17	Tootie launcher red/blue	Omega N/ mu delta Marsden ball + VMT bat Balance board standing
18	Tangram (parquetry)	Vu mate Dime and magnet Randolph shuffle and marsden ball
19	Wachs blocks flipping	Visualisation: turning lid Ballet with metronome and read hart chart Body code 3
20	Tootie launcher	Make a drawing of what you see in your mind's eye – check Star wars (this is a game on paper) Make verbally clear what you are up to

Lucky seems to be calmed down. He has a clear gaze and sparkling eyes. He stopped being the funny guy. He grew up.

Last visit to Henk, see the attachment.

As you see, my VT also involves motor exercises as well as reducing reflexes. I have been trained to do so at Hans van den Brink's office 'Instituut voor optologie' in Soest. Behavioural optometry is called 'optologie' in Holland. There is a great benefit in this as we follow the natural development. In the natural development everything works together. Although in thinking (theory models) you can use a model with hierarchy but in real life it is developing as a whole system. Therefore I sometimes try to get stereopsis as soon as I can, although the lateral system can still be immature. Where to start is always an interesting discussion.

As you can see, I use a lot of Harry Wachs (Thinking goes to school & Visual/spatial portals to thinking, feeling and movement) material. And the IVOVAC technique:

Internalize

Visualize

Organize

Vocalize

Act

Compare

The title of this thesis is: What if...

It is good to muse about that.

What if the parents did not go through all this training. Instead maybe physiotherapy, maybe INPP, MNRI, maybe check out food intake because of intolerances, maybe use medication? Or nothing at all?

In the last case I see the scenario:

Lucky does not like school.

Lucky start to behave badly.

Lucky does not get to his intellectual level.

Lucky will leave school before he had his exams.

Lucky will be a myope.

Lucky will look for the company of boys like himself and hangs out with them.

Lucky will get into trouble with the police.

Lucky is not Lucky at all.

Attachments Lucky

voornaam Lucky
achternaam
adres
woonplaats
controle Datum
client nr
behandelcode vo VO
behandel datum vo 11-4-2014
geboortedatum

habituele forie

hab forie ver -3
hab forie nabij -2

eso -/exo+

objectieve refractie

skia ver od/os	0,25	0,50
skia midden od/os		
skia nabij od/os	1,75	1,25

subjectieve refractie

ref ver mono od	0,50		6/6	
ref ver mono os	0,50	-0,25 90	6/6	-2
			6/6	
ref ver bin od	0,50			
ref ver bin os	0,75	**6/6 balans**	6/	
ref max od	0,25		6/	
ref max os	0,50		6/	
			6/6	+3

forie ver

forie ver -4 tov

ducties ver

bo ver 9 / 25 / 3
bi ver 6 / -4
silo ver mp ○ ja ◉ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 0
down /
up /

acc conv relatie

forie nabij -3
od -0,50 os -0,25
forie diss cros -5
cross od 0,25
forie cross -2,5

ductie 's nabij

tov

bo blur /break/rec 0 / 25 / 3
bi blur/break/rec 0 / 23 / 2
silo nabij mp ○ ja ◉ nee
vc ○ ja ◉ nee
hyperforie nabij 0

accommodatie

tov hab

acc amp 4,25 6/ 6
pos rel acc -1,75 > tov
neg rel acc 1,25

binoculairiteit

	stereo ver		stereo nabij	
	perif		perif	
	centraal		centraal	
	mp		vc	
pola ver	○ ja	○ nee	○ ja	○ nee
pola nabij	○ ja	○ nee	○ ja	○ nee

nieuw voorschrift

0,50 ^
0,75 -0,25 90 ^

P.D. 52 add 0,25

Habitueel

0,00 ^
0,00 ^

add

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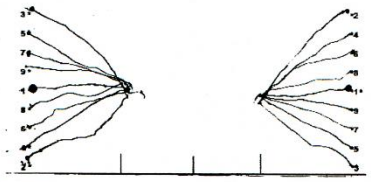
achternaam woonplaats behandelcode vo VO

behandel datum vo 11-4-2014

scanner

vo star



ocf oct

vo r perif contr. 3

vo l perif contr. 3

vo symmetrie r=l

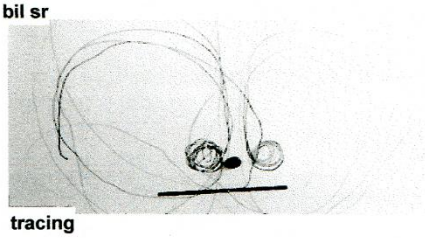
vo rechts eso/exo o

vo links eso/exo s

vo supp od os

opm ocf/sr sr sy zeer klein geen overzicht / groeter wordt zonder visueke koppeling gwemaakt en re passeert middenlijn

bil sr



tracing

bil sr rl r<l

bil sr Q recht 2

bil sr Q links 1

syntonics veldmeting

beoordeling synt veld

analyse synt veld

eenzijdige lich reflex reflex nog aanwezig

kruispatroon ○ kruisganger ◉ telganger

preferentie hand ◉ rechts ○ links

duim oppositie ○ rechts ◉ links

preferentie oog ◉ rechts ○ links

preferentie oor ○ rechts ○ links

preferentie been ○ rechts ◉ links

Yoked/Tooties

motoriek integr visueel reactie onvoldoende

corrigeren onvoldoende

leren onvoldoende

reflex tandemloop ● 0 ○ 1 ○ 2 ○ 3 ○ 4

reflex fogloop ○ 0 ○ 1 ○ 2 ● 3 ○ 4

reflex stnr ○ 0 ● 1 ○ 2 ○ 3 ○ 4

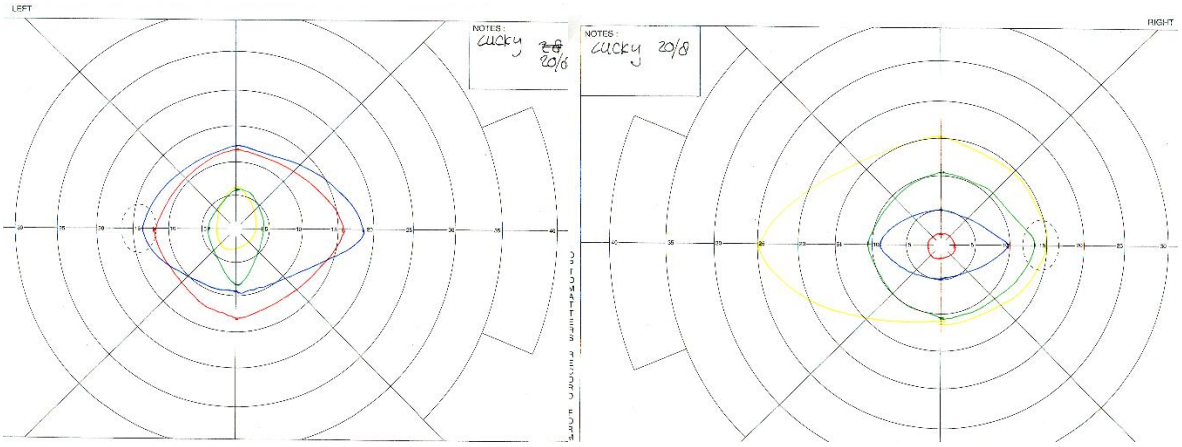
>7,5 jaar 0 optimaal - 4 max problemen

reflex atnr	○ 0	● 1	○ 2	○ 3	○ 4
reflex tlr	○ 0	○ 1	○ 2	○ 3	○ 4
reflex moro	● 0	○ 1	○ 2	○ 3	○ 4
reflex spinale galant	○ 0	○ 1	○ 2	○ 3	○ 4
angels in the snow	○ 0	○ 1	● 2	○ 3	○ 4

a/s: 1= monolateraal
2= homolateraal
3= ipsilateraal
4= contralateraal

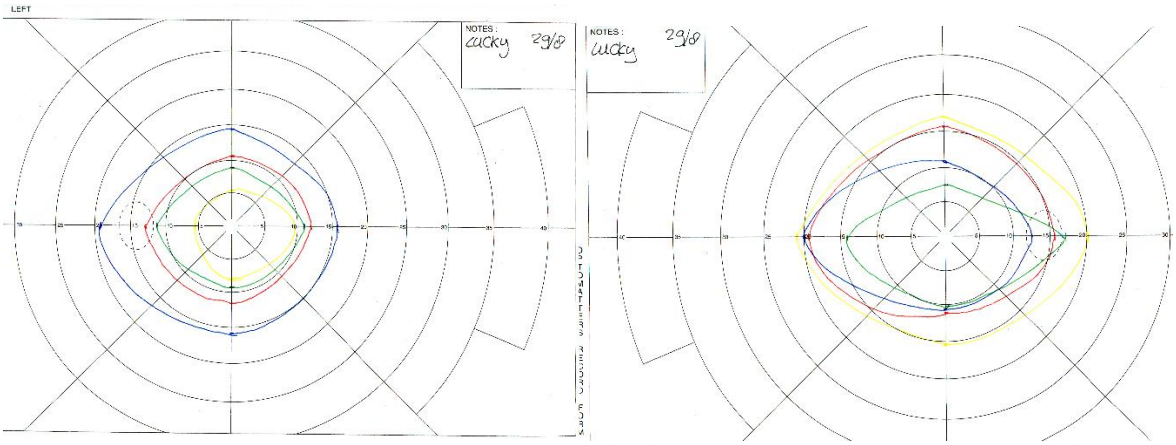
tijd	**32**
aantal x	**0**
ritme	**90 p/m**
aantal x ritme	**5**
ww verb inst	**2**

Campimetry August 20th



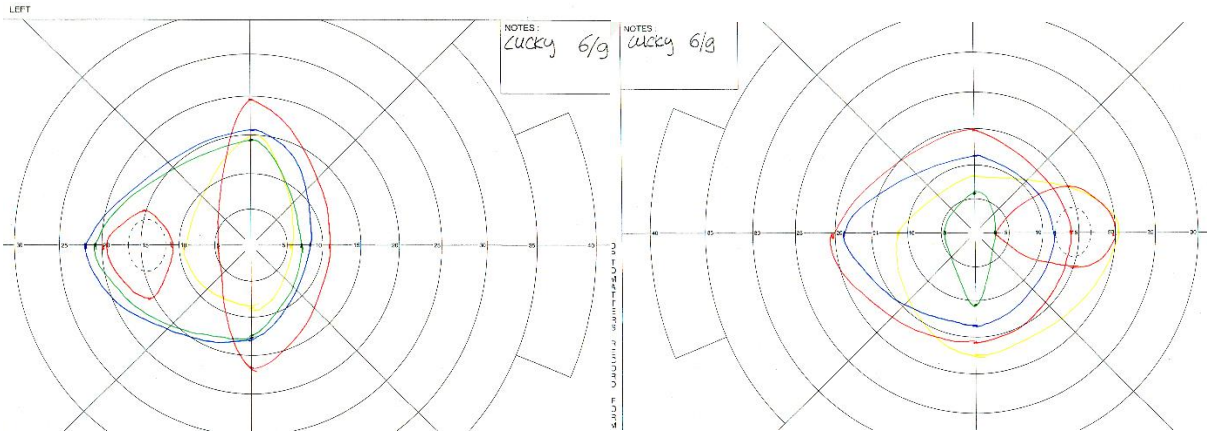
Note: no sign of the blind spot

Campimetry August 29th



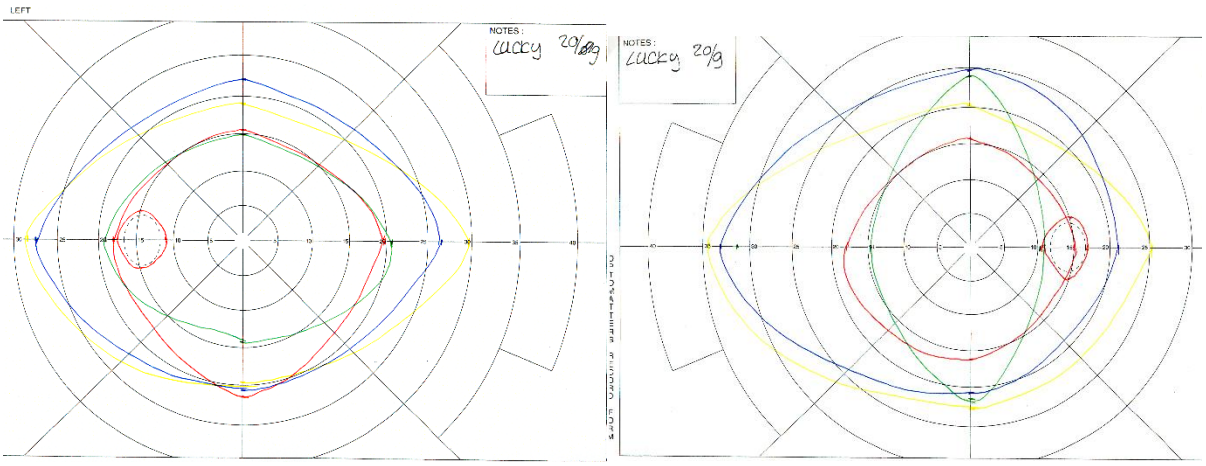
Note: no sign of the blind spot

Campimetry September 6th



Note: with a change of the alpha/omega to omega N filter, the blind spot appears.

Campimetry September 20th



voornaam Lucky | adres | client nr
achternaam | woonplaats | behandelcode vo VC
controle Datum | behandel datum vo 7-11-2014
geboortedatum

habituele forie

hab forie ver -5 eso -/exo+
hab forie nabij 1,5

objectieve refractie

skia ver od/os 1,50 1,25
skia midden od/os
skia nabij od/os 1,75 1,50

subjectieve refractie

ref ver mono od 0,75 6/8 +
ref ver mono os 0,75 6/8 +
6/6
ref ver bin od 1,25
ref ver bin os 1,25 **6/6 balans** 6/ 5
ref max od 6/
ref max os 6/
6/5

forie ver

forie ver -1 tov

ducties ver

bo ver 6 / 23 / 6
bi ver 9 / 1
silo ver mp ○ ja ◉ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 0
down /
up /

acc conv relatie

forie nabij 1,5
od 1,75 os 1,75
forie diss cros 2,5
cross od 1,75
forie cross 3

ductie 's nabij

tov

bo blur /break/rec 13 / 23 / 3
bi blur/break/rec 6 / 18 / 6
silo nabij mp ○ ja ◉ nee
vc ◉ ja ○ nee
hyperforie nabij 0

accommodatie

tov 7balans

acc amp 5,75 6/ 6
pos rel acc -2,25 > tov
neg rel acc 1,00

binoculairiteit

	stereo ver	stereo nabij
perif	2	3
centraal	3	5

	mp		vc	
pola ver	○ ja	○ nee	○ ja	○ nee
pola nabij	○ ja	○ nee	○ ja	○ nee

nieuw voorschrift

1,25 ^
1,25 ^

P.D. 52 add 0,00

Habitueel

0,50	-0,50	40	^
0,75	-0,25	90	^

add

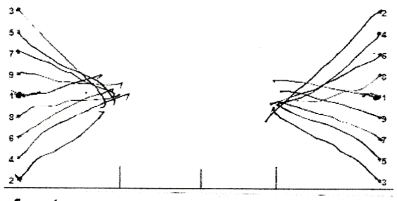
voornaam Lucky adres client nr

achternaam woonplaats behandelcode vo VC

behandel datum vo 7-11-2014

scanner

vo star



ocf oct

vo r perif contr.

vo l perif contr.

vo symmetrie

vo rechts eso/exo

vo links eso/exo

vo supp od os

opm ocf/sr

bil sr

bil sr rl

bil sr Q recht

bil sr Q links

tracing

syntonics veldmeting

beoordeling synt veld

analyse synt veld

eenzijdige lich reflex

kruispatroon ○ kruisganger ○ telganger

preferentie hand ○ rechts ○ links

duim oppositie ○ rechts ○ links

preferentie oog ○ rechts ○ links

preferentie oor ○ rechts ○ links

preferentie been ○ rechts ○ links

Yoked/Tooties

motoriek integr visueel reactie

corrigeren

leren

reflex tandemloop ○0 ○1 ○2 ○3 ○4

reflex fogloop ○0 ○1 ○2 ○3 ○4

reflex stnr ○0 ○1 ○2 ○3 ○4

>7,5 jaar

0 optimaal - 4 max problemen

voornaam Lucky | adres | client nr
achternaam | woonplaats | behandelcode vo VC
controle Datum | behandel datum vo 22-06-2015
geboortedatum

habituele forie

hab forie ver -0,5 eso -/exo+
hab forie nabij 1

objectieve refractie

skia ver od/os 1,00 1,00
skia midden od/os
skia nabij od/os 1,75 1,75

subjectieve refractie

ref ver mono od 1,00 6/5 -2
ref ver mono os 1,00 6/5 -2
6/4 -2
ref ver bin od 1,50
ref ver bin os 1,50 **6/6 balans** 6/ 6
ref max od 1,50 6/
ref max os 1,50 6/
6/4 -2

forie ver

forie ver 2,5 tov 7balans

ducties ver

bo ver 10 / 28 / 6
bi ver 11 / 3
silo ver mp ○ ja ◉ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 0
down /
up /

acc conv relatie

forie nabij -2
od 1,50 os 1,75
forie diss cros 3,5
cross od 1,50
forie cross 0,50

ductie 's nabij

tov

bo blur /break/rec 13 / 24 / 3
bi blur/break/rec 19 / 19 / 6
silo nabij mp ○ ja ◉ nee
vc ◉ ja ○ nee
hyperforie nabij 0

accommodatie

tov

acc amp 5,50 6/ 6
pos rel acc -1,50 > tov 7balans
neg rel acc 075,

binoculairiteit

stereo ver		stereo nabij	
perif 2		perif 3	
centraal 3		centraal 6	
	mp		vc
pola ver	○ ja ◉ nee		○ ja ○ nee
pola nabij	○ ja ◉ nee		○ ja ○ nee

nieuw voorschrift

1,25 ^
1,25 ^

P.D. 52 add 0,00

Habitueel

1,25 ^
1,25 ^

add

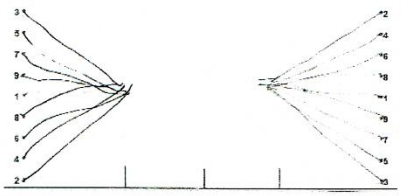
voornaam
achternaam

adres
woonplaats

client nr
behandelcode vo VC
behandel datum vo 22-06-2015

scanner

vo star



ocf oct

vo r perif contr. 4
vo l perif contr. 4
vo symmetrie |=<r
vo rechts eso/exo s
vo links eso/exo o
vo supp od os n.v.t.

opm ocf/sr

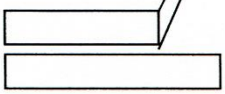
bil sr

bil sr rl
bil sr Q recht
bil sr Q links

tracing

syntonics veldmeting

beoordeling synt veld
analyse synt veld



eenzijdige lich reflex

kruispatroon ○ kruisganger ○ telganger

preferentie hand ○ rechts ○ links
duim oppositie ○ rechts ○ links
preferentie oog ○ rechts ○ links
preferentie oor ○ rechts ○ links
preferentie been ○ rechts ○ links

Yoked/Tooties

motoriek integr visueel reactie
corrigeren
leren

reflex tandemloop ○0 ○1 ○2 ○3 ○4
reflex fogloop ○0 ○1 ○2 ○3 ○4
reflex stnr ○0 ○1 ○2 ○3 ○4

>7,5 jaar

0 optimaal - 4 max problemen

Chapter 4

There has been numerous articles about myopia. This one shows that there will be an enormous increase of myopia worldwide (see attachment 2, page 63.

I am not surprised and yet very shocked.

It is evident that by now you can conclude that it comes with prosperity, as shown in table 1. Some say that myopia is inherited, but you can hardly maintain that. It is known to develop by too much tension while reading up close, too long reading up close with too little pause, bad lit rooms, too little natural light, little exercise, sugar intake and so on.

High income is often due to high level of education. And the urge to be successful in your job as well as keeping up with the Joneses. So there is much pressure to become high in ranking.

In some cultures wearing glasses is a symbol of being successful in society. Academic education. So people don't mind. They are even proud about it.

In Holland there also was an article (Carolien Klaver – Erasmus University Rotterdam) about the connection between developing myopia with children and the time spend playing outdoors. Again I am not surprised about that. As playing is a natural thing to do for children (and adults alike!) and gazing at screens is not.

Martha Nussbaum wrote an eye opening book: Not for profit. In which she points out that the civilized countries have made education systems where high emphasis lays on educating to be successful in economic rewarding subjects. And efface school subject as art, theatre and crafts.

The one leads to pressure - the other to creativity.

Pressure leads to stress, illness, oh we all know. Creativity leads to problem solving, playfulness and tolerance. Not hard to choose what to prefer.

Of course we cannot change achievements of civilisation, we cannot go back in time. We may even not go back to a more natural way of living. Progress is all around.

But we must take these signals seriously and make plans for education, to balance the school subjects. Make people aware of their myopic behaviour. Slow down that process by prescribing plus for reading and playing on the iPad.

Steven Ingersoll founded three schools in the USA. Every student will be examined on visual maturity. No reading or writing until developed to the required level. He came to the conclusion that in general boys will be ready to read without damage to the system on the age of 10, girls on the age of 8. An alarming conclusion. Things need to change.

I find it also a sign of depression (along with obesities and all those 'abbreviations' children suffer from nowadays) as all these thing depress the natural playfulness that we humans have.

Chapter 5

"'Well, our little man,' said god. 'You have waited till the last, and slept on your decision, and we are sure you have been thinking hard all the time. What can we do for you?'

'Please god,' said the embryo, 'I think that you made me in the shape which I now have for reasons best known to yourselves, and that it would be rude to change. If I am to have my choice I will stay as I am. I will not alter any of the parts which you gave me, for other and doubtless inferior tools, and I will stay a defenceless embryo all my life, doing my best to make myself a few feeble implements out of the wood, iron and the other materials which you have seen fit to put before me. If I want a boat, I will try to construct it out of trees, and if I want to fly, I will put together a chariot to do it for me. Probably I have been very silly in refusing to take advantage of your kind offer, but I have done my very best to think it over carefully, and now hope that the feeble decision of this small innocent will find favour with yourselves.'

'Well done,' exclaimed the creator in delighted tones.

'Here, all you embryos, come here with your beaks and whatnots to look upon our first man. He is the only one who has guessed our riddle, out of all of you, and we have great pleasure in conferring upon him the order of dominion over the fowls of the air, and the beasts of the earth, and the fishes of the sea. Now let the rest of you get along, and love and multiply, for it is time to knock off for the week-end. As for you, man, you will be a naked tool all your life, though a user of tools. You will look like an embryo till they bury you, but all the others will be embryos before your might. Eternally undeveloped, you will always remain potential in our image, able to see some of our sorrows and to feel some of our joys. We are partly sorry for you, man, but partly hopeful. Run along then, and do your best. And listen, man, before you go...'

'Well?' asked Adam, turning back from his dismissal.

'We were only going to say,' said god shyly, twisting their hands together. 'Well, we were just going to say, god bless you.'"

The badger explains what makes mankind feeble. What are his blessings and what are his handicaps? The vulnerability of the system causes damage to development. In the next case the damage was almost irreversible.

July 18th 2016

It's a beautiful sunny summers day. Waterland, north of Amsterdam. Green meadows - cattle - typical farmhouses - a canal on my left: very Dutch. I'm in the bus on my way to visit Henk. Henk is a behavioural optometrist. He is usually doing the analytical for me. I never work without that. Speaking on the phone to discuss the results and make plans for treatment is part of the procedure. This time we meet in his office. I need his help with this essay. He has made the computer program we share. It is made in bold colours and I want a white background. I also like to go through Kahmal's case. It is a very complicated one. Kahmal was very responsive to the suggestions we gave. It worked out fine, but it's a work in progress.

Henk called me to ask if I was willing to try this, as it would be heavy work. I said all right. The initial analytical was done on the 19th of February 2014. I met Kahmal on the 12th of April. Of course I first had to explain what the family could expect from the therapy: how much work it might be, how many changes we would make in the prescription along the way. I also talked about using syntonics. With Kahmal I would never do VT without it. No way.

You can find the results of the analysis in the attachment after this chapter on page 35.

Information from Henk: Kahmal is an amblyope, very myopic, anisometric, high esophore and the lateralisation process has not been right. First we need to work on balance, peripheral awareness and he needs to become conscious of visuality. He needs a therapeutic pair of glasses, only to use when practicing, instead of lenses (Kahmal wears contact lenses by the way). Kahmal has got his driver's licence but does not feel safe in the car as there is no depth perception. So maybe we could fix that? Re-examine after summer break.

When I met Kahmal for the first time, I say a boy with halve closed eyes as if his eyelid muscles were tired. He spoke in a very low deep voice, using very little words. Like the singers Kahmal (that is why I gave him

this name) or Mark Lanegan (more of this day and age). His head was often tilted. Usually his mother came along with him. She had to coach him in the home procedures.

Session	In office	VT home
1	Intake and campimetry	Marsden ball pursuits monocular lying down Balance board sitting and standing Thumbs peripheral stimulation
2	Instruction on the use of the colorboy	Syntonics Alfa delta/ mu delta start 5 minutes each Saccades in room Scan objects far and near
3	Campimetry Tootie launcher, catch as much as you can	Continue syntonics, up to max of 8 minutes each Wear red/ blue/green goggles and watch a white wall
4	Campimetry Tootie launcher	Continue syntonics and repeat all previous exercises Red and green square carton - walk away and back
5	Campimetry Jump ductions on Bernells vecto's no 2	Syntonics Hearts vecto, BI and BO Same carton, now with black dot in it.
6	Campimetry Tootie launcher red and blue	Continue syntonics Push ball Hearts vecto 2 trombone Brock string (no beads)
7	Tootie launcher red and blue – swap Cheiroscopy (thicken the lines)	Repeat previous session
8	Holiday plan	Marsden ball and VMT bat, also standing on balance board Physiological diplopia Monocular pointer in perforated template.

I made a reminder for the holiday period, since he would not be here.

Vakantieplan voor Kahmal

Doe alle dagen twee oefeningen, één om het amblyopie oog te stimuleren en één om stereo zien te oefenen. Besteed daar 15 minuten aan.

Zet de oefenbril zeker een uur achter elkaar op in huis, het mag ook langer.

Ga met die bril op ook balspel doen.

Beweeg je ogen om vormen heen, doe dat zo vaak je er maar aan denkt.

Word een actieve kijker.

Houd de periferie in de gaten, ook als je op je tablet bezig bent, houd je gezichtsveld ruim.

Let op je hoofdhouding: recht, de ogen op een mooi horizontaal vlak, en houd afstand van je werk als je dichtbij werkt.

Ga op het eind van de vakantie naar Henk voor controle.

Maak dan weer een afspraak hier.

Ciska

Translation:

"Do two exercises every day, for about 15 minutes. One to stimulate the amblyopic eye and one to practise stereo.

Wear the training glasses every day for one hour or more. Join a ball game wearing these glasses.

Move your eyes around objects, as many times as you can.

Become active in seeing the world.

Watch your periphery, especially while playing on your tablet, keep a wide vision.

Keep your head straight, keep your eyes horizontally and keep a distance from your book or tablet while working.

After the holidays go see Henk and make an appointment here afterwards.

Ciska"

Kahmal went to see Henk on the 24th of September 2014 to see what has changed. Look for yourself in the attachment.

I was stunned when I saw this.

Henk's comment: there is anomaly retinal correspondence. There is much more balance in the system. The contacts can be diminished in minus (a bit). Extra plus gives exo (so he gets that in his training glasses). There is hyperopia: train with prism, combined with the plus. Do as many duction training as you can. These is SILO response at near. Vision of the left eye changed spectacularly. Van Orden star shows a much better centering.

Kahmal needs to wear his previous glasses in nearby situations.

And on we went:

Session	In office	VT home
9	Explain Henk's findings Vectograms	0 I 0 Periphery chard Brock string
10	Vectograms	Brock string with prism Pursuit Marsden ball also diagonally Palm and push the eyes forward
11	Bernell vecto circus	Big fusion circles Eye stretching Pursuit finger

Kahmal has a habit of lying in bed until noon and is very slow during the afternoon. And he goes to bed late. I believe it's a good plan to do

something about that, so I advised two weeks of syntonics (alpha omega and mu delta). There was an alpha omega pupil. I wanted him to be more animated.

12	Talk and campimetry	Syntonics Alfa omega/ mu delta Optomatters OPT LC 2
13	Talk and campimetry	Optomatters OPT 1 and 2 Four corner fixations Double vecto for jump ductions
14	Tootie launcher red and blue	Vision star pursuit Special events and walk to and fro Tootie under the leg - throw and catch
15	VO star Polaroid quoits	Monocular dots in circle Vision star saccades Brock string using S syntonics filter
16	Cheiroscopy	Fusion on thumbs, BI and BO Pointer in perforated board using S Standing ball pursuit with dissociation prism

The 29th of May 2015: Kahmal was examined by Henk for the third time.

This is what Henk told me: we change the plus addition for nearby. We need to teach him visualisation as he is far too analytical. Enlarge the fusion reserves on both sides: BI and BO. We need to create flexibility. Kahmal needs to use this new way of looking in sports. There is still a slight difference in vision between the eyes. Stereo needs attention as in the bioptertest Kahmal fails a few tests. Repeat the same exercises, make them look new.

Session	In office	VT home
17	Explain what Henk found Biopter book BI	Fusion circles far and near Monocular +/- flipper 1.00 Sun bathing for the eyes
18	Biopter ball with two pointers	Using S pursuit lines in the room (also visualized ones) Fuse BI and BO using loose prism Draw mirrored lines
19	Cheiroscopy Visual behaviour talk	Neck rotations Heart vecto bi Accommodation rock on Hart chart
20	Vecto's again	Mirror cheiroscope

The last time I saw Kahmal was January 2016. Already he was slowing down his training. He had enough of it, he couldn't bring himself to exercise anymore.

He came to give some material back. He suggested maybe after a six month break...

It is amazing how far he got in such a short time. And how he did not follow all the advises, like go and do basketball (he comes from a basketball family). But the most striking change was his speech. He changed from someone that only commented with one or two words on my questions into somebody who spoke full sentences and better still: gave his interpretations on what he saw and criticized his mother.

I like to add something, my personal view, on amblyopia. I think that amblyopic people stay - in a way - in an symbiotic state. The amblyopic child is not visually developed and thinks that the mother sees the same as himself. He cannot understand that he is supposed to explain what is inside him. He lacks visualisation. His mother is supposed to be able to read his mind. Both get used to that and so it becomes a pattern of co-dependency.

So when I did the vectograms with Kahmal I have taken a length of time to coach him to express what he experienced, what it looked like. He used a pointer to touch. Even if he had no words for it: he had to try to make himself clear. I told him: 'I cannot see what you see, nor can I know how you interpret it.' This expansivity is a sign of maturing, as you also see in Lucky's case.

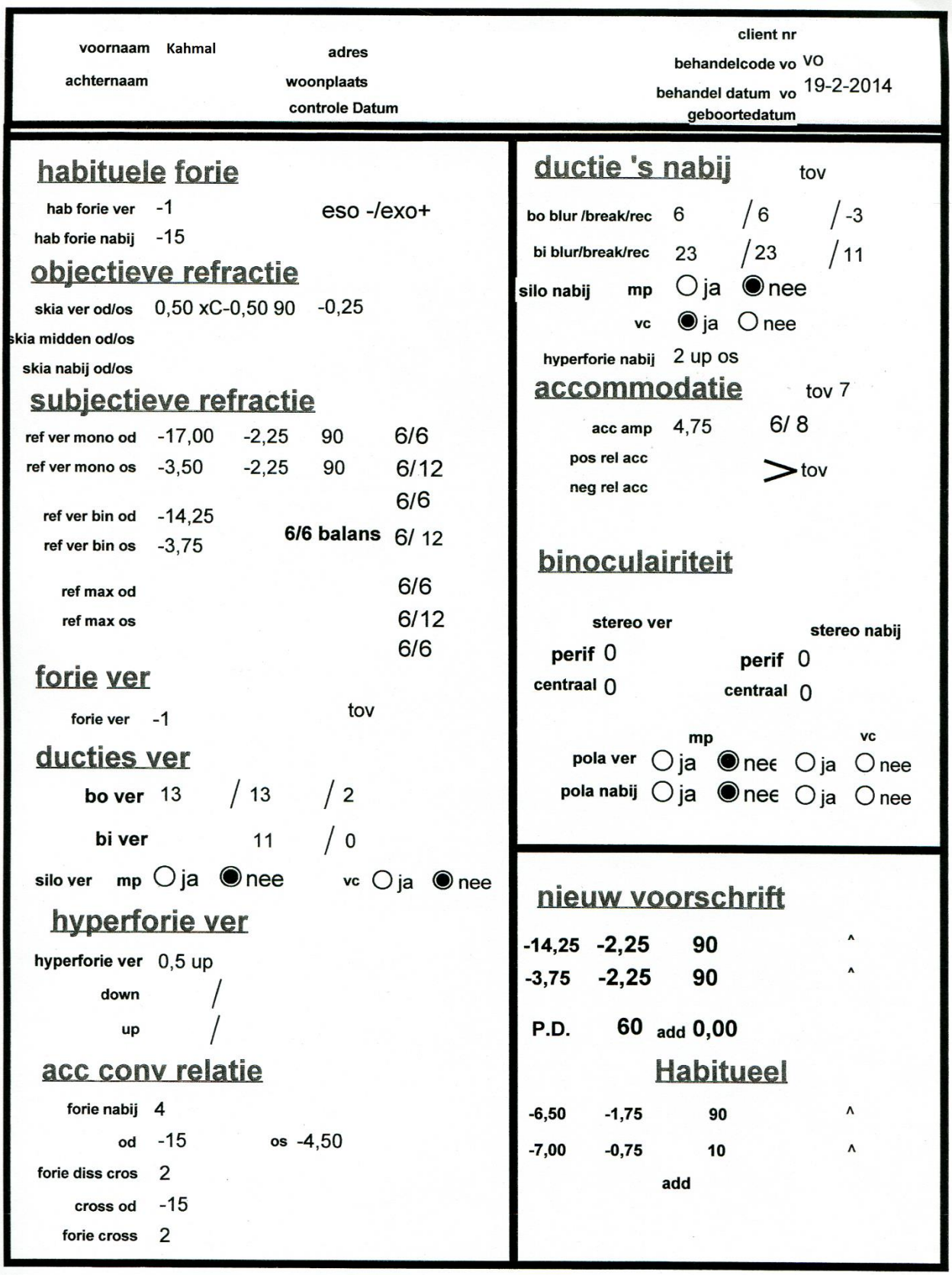
I also explained this to his mother, she recognized this to be true. And changed her ways.

And his eyelids are normal now, by the way.

I wonder:

What if Kahmal came to us when he was younger, let's say 7 or 8 years old. And that we helped him like we did now. How would his life have been like then? What more could he have developed?

Attachments Kahmal



voornaam Kahmal
achternaam
adres
woonplaats
controle Datum
client nr
behandelcode vo VO
behandel datum vo 19-2-2014
geboortedatum

habituele forie

hab forie ver -1
hab forie nabij -15
eso -/exo+

objectieve refractie

skia ver od/os 0,50 xC-0,50 90 -0,25
skia midden od/os
skia nabij od/os

subjectieve refractie

ref ver mono od	-17,00	-2,25	90	6/6
ref ver mono os	-3,50	-2,25	90	6/12
				6/6
ref ver bin od	-14,25			
ref ver bin os	-3,75	6/6 balans		6/ 12
ref max od				6/6
ref max os				6/12
				6/6

forie ver

forie ver -1 tov

ducties ver

bo ver 13 / 13 / 2
bi ver 11 / 0
silo ver mp ○ ja ◉ nee vc ○ ja ◉ nee

hyperforie ver

hyperforie ver 0,5 up
down /
up /

acc conv relatie

forie nabij 4
od -15 os -4,50
forie diss cros 2
cross od -15
forie cross 2

ductie 's nabij

tov

bo blur /break/rec 6 / 6 / -3
bi blur/break/rec 23 / 23 / 11
silo nabij mp ○ ja ◉ nee
vc ◉ ja ○ nee
hyperforie nabij 2 up os

accommodatie

tov 7

acc amp 4,75 6/ 8
pos rel acc > tov
neg rel acc

binoculairiteit

	stereo ver	stereo nabij
perif	0	0
centraal	0	0

	mp		vc	
pola ver	○ ja	◉ nee	○ ja	○ nee
pola nabij	○ ja	◉ nee	○ ja	○ nee

nieuw voorschrift

-14,25 -2,25 90 ^
-3,75 -2,25 90 ^

P.D. 60 add 0,00

Habitueel

-6,50 -1,75 90 ^
-7,00 -0,75 10 ^
add

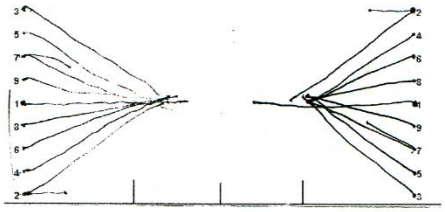
voornaam Kahmal adres client nr

achternaam woonplaats behandelcode vo VO

behandel datum vo 19-2-2014

scanner

vo star



ocf oct

vo r perif contr. 3

vo l perif contr. 3

vo symmetrie r<l

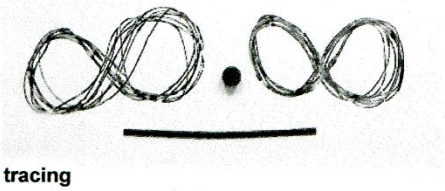
vo rechts eso/exo o

vo links eso/exo s

vo supp od os centrale

opm ocf/sr

bil sr



tracing

bil sr rl r<l

bil sr Q recht 4

bil sr Q links 2

syntonics veldmeting

beoordeling synt veld

analyse synt veld

eenzijdige lich reflex reflex nog aanwezig

kruispatroon ◉ kruisganger ○ telganger

preferentie hand ○ rechts ○ links

duim oppositie ◉ rechts ○ links

preferentie oog ◉ rechts ○ links

preferentie oor ◉ rechts ○ links

preferentie been ◉ rechts ○ links

Yoked/Tooties

motoriek integr visueel reactie onvoldoende

corrigeren onvoldoende

leren matige

reflex tandemloop ● 0 ○ 1 ○ 2 ○ 3 ○ 4

reflex fogloop ● 0 ○ 1 ○ 2 ○ 3 ○ 4

reflex stnr ○ 0 ○ 1 ○ 2 ○ 3 ○ 4

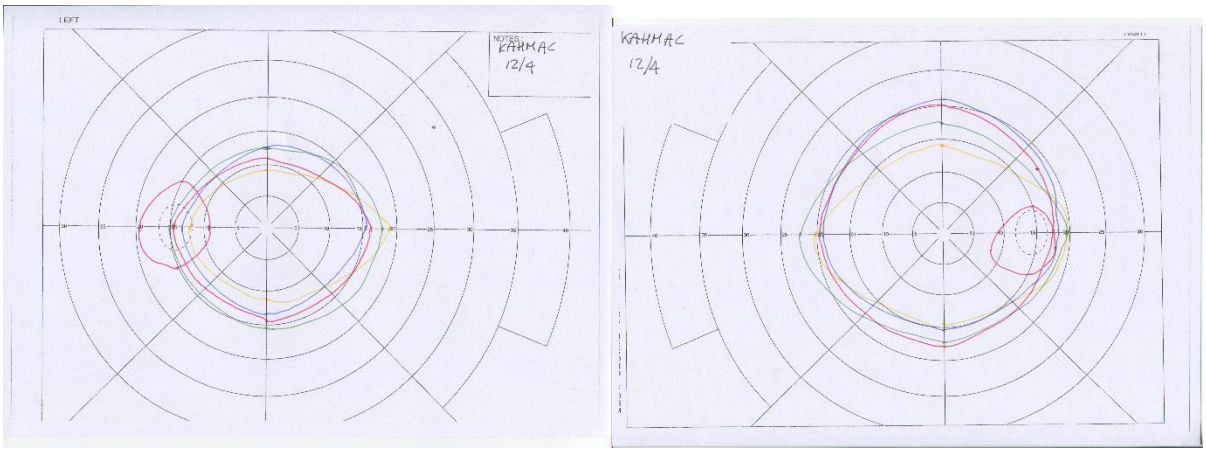
>7,5 jaar 0 optimaal - 4 max problemen

reflex atnr	○ 0	○ 1	○ 2	○ 3	○ 4
reflex tlr	○ 0	○ 1	○ 2	○ 3	○ 4
reflex moro	○ 0	○ 1	○ 2	○ 3	○ 4
reflex spinale galant	○ 0	○ 1	○ 2	○ 3	○ 4
angels in the snow	○ 0	○ 1	○ 2	○ 3	● 4

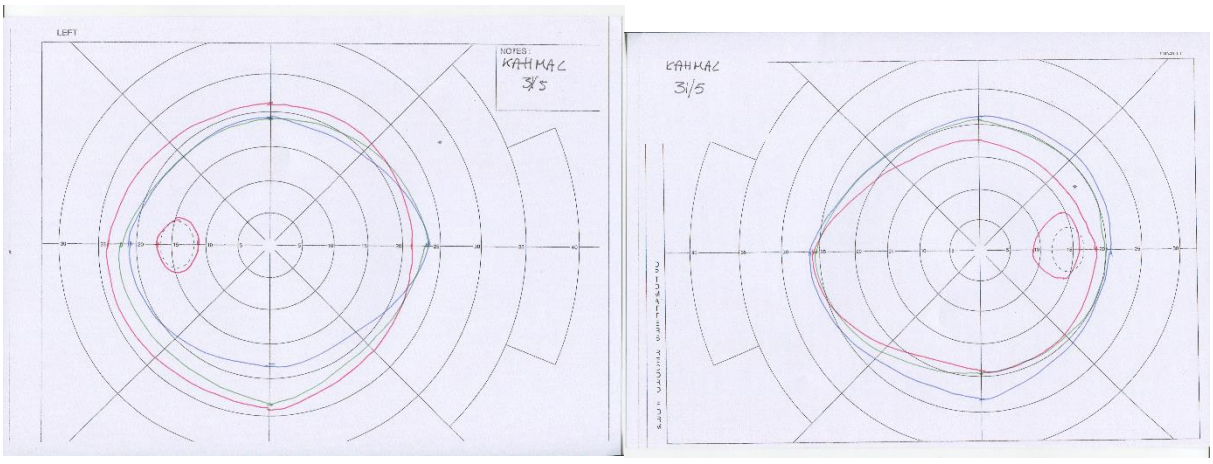
a/s: 1= monolateraal
2= homolateraal
3= ipsilateraal
4= contralateraal

tijd	**32**
aantal x	**1**
ritme	**90 p/m**
aantal x ritme	**0**
ww verb inst	

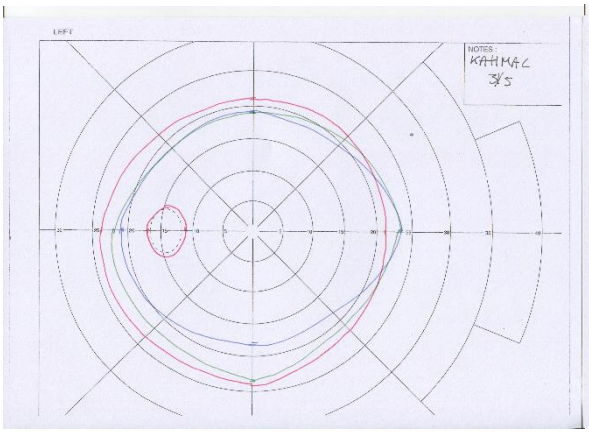
Campimetry April 12th

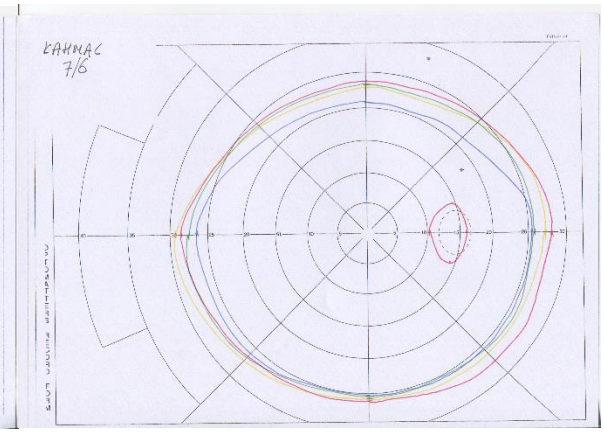


Campimetry May 31st



Campimetry June 7th





voornaam Kahmal | adres | client nr

achternaam | woonplaats | behandelcode vo VC

controle Datum | behandel datum vo 24-9-2014

geboortedatum

habituele forie

hab forie ver -8 eso -/exo+

hab forie nabij -2

objectieve refractie

skia ver od/os	1,50	0,25
skia midden od/os		
skia nabij od/os	2,00	1,00

subjectieve refractie

ref ver mono od	0,25	-0,50	90	6/6	-
ref ver mono os	0,25	-0,50	90	6/8	-1
ref ver bin od	0,50			6/	
ref ver bin os	0,25		6/6 balans	6/ 6	-2
ref max od				6/	
ref max os				6/	
				6/6	

forie ver

forie ver -6 tov

ducties ver

bo ver	14	/ 18	/ 8
bi ver		2	/ -2

silo ver mp ○ ja ◉ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 2,25 up os

down /

up /

acc conv relatie

forie nabij -1

od 1,00 os 0,75

forie diss cros 2

cross od -0,75

forie cross -2,5

ductie 's nabij tov

bo blur /break/rec	8	/ 17	/ 0
bi blur/break/rec	6	/ 6	/ -2

silo nabij mp ○ ja ◉ nee

vc ◉ ja ○ nee

hyperforie nabij 2,5 up os

accommodatie tov

acc amp	6,50	6/ 8
pos rel acc	-0,75	> tov
neg rel acc	0,5	

binoculairiteit

stereo ver		stereo nabij	
perif	0	perif	0
centraal	0	centraal	2

	mp		vc	
pola ver	○ ja	◉ nee	○ ja	○ nee
pola nabij	○ ja	◉ nee	○ ja	○ nee

nieuw voorschrift

0,75 -0,50 90 ^

0,50 -0,50 90 ^

P.D. 60 add 0,00

Habitueel

^

^

add 1,50

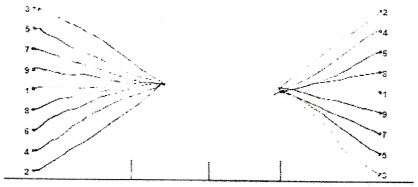
voornaam Kahmal adres client nr

achternaam woonplaats behandelcode vo VC

behandel datum vo 24-9-2014

vo star

scanner



ocf oct

vo r perif contr. 4

vo l perif contr. 4

vo symmetrie r<l

vo rechts eso/exo o

vo links eso/exo s

vo supp od os centrale

opm ocf/sr

bil sr

bil sr rl

bil sr Q recht

bil sr Q links

tracing

syntonics veldmeting

beoordeling synt veld

analyse synt veld

eenzijdige lich reflex

kruispatroon ○ kruisganger ○ telganger

preferentie hand ○ rechts ○ links

duim oppositie ○ rechts ○ links

preferentie oog ○ rechts ○ links

preferentie oor ○ rechts ○ links

preferentie been ○ rechts ○ links

Yoked/Tooties

motoriek integr visueel reactie

corrigeren

leren

reflex tandemloop ○0 ○1 ○2 ○3 ○4

reflex fogloop ○0 ○1 ○2 ○3 ○4

reflex stnr ○0 ○1 ○2 ○3 ○4

>7,5 jaar

0 optimaal - 4 max problemen

voornaam Kahmal | adres | client nr
achternaam | woonplaats | behandelcode vo VC
controle Datum | behandel datum vo 29-5-2015
geboortedatum

habituele forie

hab forie ver -0,5 eso -/exo+
hab forie nabij 5

objectieve refractie

skia ver od/os 0,50 0,0
skia midden od/os
skia nabij od/os 1,50 1,50

subjectieve refractie

ref ver mono od +0,25 6/6
ref ver mono os -0,25 6/8
6/6
ref ver bin od +0,25
ref ver bin os -0,50 **6/6 balans** 6/ 6
ref max od +0,25 6/
ref max os -0,50 6/
6/6 +3

forie ver

forie ver -3 tov

ducties ver

bo ver 12 / 14 / 9
bi ver 2,5 / 0
silo ver **mp** ◉ ja ○ nee **vc** ◉ ja ○ nee

hyperforie ver

hyperforie ver 0
down /
up /

acc conv relatie

forie nabij 4
od 1,00 os 1,00
forie diss cros 7
cross od 1,50
forie cross 8

ductie 's nabij

tov

bo blur /break/rec 16 / 18 / 11
bi blur/break/rec 8 / 18 / 11
silo nabij **mp** ◉ ja ○ nee
vc ○ ja ◉ nee
hyperforie nabij 0

accommodatie

tov 7balans

acc amp 3,75 6/ 6
pos rel acc -0,25 > tov hab
neg rel acc 0,75

binoculairiteit

stereo ver		stereo nabij	
perif 0		perif 0	
centraal 0		centraal 3	
	mp		**vc**
pola ver	○ ja ◉ nee		○ ja ○ nee
pola nabij	○ ja ◉ nee		○ ja ○ nee

nieuw voorschrift

0,00 ^
0,00 ^

P.D. 60 add 1,00

Habitueel

-6,00 -1,75 90 ^
-6,00 -0,75 10 ^
add 1,50

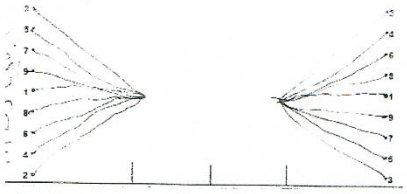
voornaam Kahmal adres client nr

achternaam woonplaats behandelcode vo VC

behandel datum vo 29-5-2015

vo star

scanner



ocf oct

vo r perif contr. 5

vo l perif contr. 5

vo symmetrie r<l

vo rechts eso/exo s

vo links eso/exo s

vo supp od os

opm ocf/sr

bil sr

bil sr rl

bil sr Q recht

bil sr Q links

tracing

syntonics veldmeting

beoordeling synt veld

analyse synt veld

eenzijdige lich reflex

kruispatroon ○ kruisganger ○ telganger

preferentie hand ○ rechts ○ links

duim oppositie ○ rechts ○ links

preferentie oog ○ rechts ○ links

preferentie oor ○ rechts ○ links

preferentie been ○ rechts ○ links

Yoked/Tooties

motoriek integr visueel reactie

corrigeren

leren

reflex tandemloop ○0 ○1 ○2 ○3 ○4

reflex fogloop ○0 ○1 ○2 ○3 ○4

reflex stnr ○0 ○1 ○2 ○3 ○4

>7,5 jaar

0 optimaal - 4 max problemen

Chapter 6

‘“Put it like this. There was a king once, called King Arthur. That is me. When he came to the throne of England, he found that all kings and barons were fighting against each other like madmen, and, as they could afford to fight in expensive suits of armour, there was practically nothing which could stop them from doing what they pleased. They did a lot of bad things, because they lived by force. Now this king had an idea, and the idea was that force ought to be used, if it were used at all, on behalf of justice, not on its own account. Follow this, young boy. He thought that if he could get his barons fighting for truth, and to help weak people, and to redress wrongs, then their fighting might not be such a bad thing as once it used to be. So he gathered together all the true and kindly people that he knew, and he dressed them in armour, and he made them knights, and taught them his idea, and set them down, at a Round Table. There were a hundred and fifty of them in the happy days, and King Arthur loved his Table with all his heart. He was prouder of it than he was of his own dear wife, and for many years his new knights went about killing ogres, and rescuing damsels and saving poor prisoners, and trying to set the world to rights. That was the King’s idea.’

‘I think it was a good idea, my lord.’

‘It was, and it was not. God knows.’

‘What happened to the King in the end?’ asked the child, when the story seemed to have dried up.

‘For some reason, things went wrong. The Table split into factions, a bitter war began, and all were killed.’

The boy interrupted confidently.

‘No,’ he said, ‘not all. The King won. We shall win.’

Arthur smiled vaguely and shook his head. He would have nothing but the truth.

‘Everybody was killed,’ he repeated, ‘except a certain page. I know what I am talking about.’

‘My lord?’

‘This page was called young Tom of Newbold Revell near Warwick, and the old King sent him off before the battle, upon pain of dire disgrace. You see, the King wanted there to be somebody left, who would remember their famous idea. He wanted badly that Tom should go back to Newbold revel, where he could grow into a man and live his life in Warwickshire peace – and he wanted him to tell

everybody who would listen about this ancient idea, which both of them had once thought good. Do you think you could do that, Thomas, to please the King?'

The child said, with the pure eyes of absolute truth: 'I would do anything for King Arthur.'

'That's a brave fellow. Now listen, man. Don't get these legendary people muddled up. It is I who tell you about my idea. It is I who am going to command you to take horse to Warwickshire at once, and not to fight with your bow tomorrow at all. Do you understand all this?'

'Yes, King Arthur.'

'Wil you promise to be careful of yourself afterward? Will you try to remember that you are a kind of vessel to carry on the idea, when things go wrong, and that the whole hope depends on you alive?'

'I will.'

'It seems selfish of me to use you for it.'

'It is a honour of your poor page, good my lord.'

'Thomas, my idea of those knights was a sort of candle, like these ones here. I have carried it for many years with a hand to shield it from the wind. It has flickered often. I am giving you the candle now – you won't let it out?'

'It will burn.'

'Good Tom. The light-bringer. How old did you say you were?'

'Nearly thirteen.'

'Sixty more years then, perhaps. Half a century.'

'I will give it to other people, King. English people.'

'You will say to them in Warwickshire: Eh, he wor a wonderly fine candle?'

'Aye, lad, that I will.'

'Then 'tis: Na, Tom, for thee must go right quickly. Thou'lt take the best son of a mare that thee kinst find, and thou wilt ride post into Warwickshire, lad, wi' nowt but the curlew?'

'I will ride post, mate, so that the candle burn.'

'Good Tom, then god bless 'ee. Doant thee ferget thick Bishop of Rochester, afore thou goest.'

The little boy kneeled down to kiss his master's hand – his surcoat, with the Malory bearing, looking absurdly new.

'My lord of England,' he said.

Arthur raised him gently, to kiss him on the shoulder.

'Sir Thomas of Warwick,' he said – and the boy was gone."

The king needed to have his idea put into the world again. That's why Thomas needed to stay alive.

What is there to say about Beau Or Belle (BOB for short), because the page can be boy or girl, what she cannot say herself?

I will fill in the data and BOB will put a few words alongside. Nice deal.

BOB went to see Henk. It is 27th of July 2013. A very hot day it was. You can find the results of the analysis on page 49

Henk's remarks: the system is stuck and unstable. The problem is reading: she feels uncomfortable when she reads. There is a cylinder. It is a convergence problem. She can do with extra plus (for now: only in training situation). We must make integrated patterns. We hope to reduce the astigmatism and the acceptance of more plus at distance. Van Orden star shows exo. Moro reflex is still there. Syntonics: flattened fields.

I see BOB twice before she takes a long break to visit a project in South Africa. We start with syntonics when she gets back.

Session	In office	VT home
1	Intake and plan	Pursuits with marsden ball, lying down Push ball with the same ball Physiological diplopia
2	Tootie launcher	Brock string with training glasses Throw Tootie underneath leg and catch 0I0 BO

BOB returns after 8 months and we start syntonics.

Session	In office	VT home
3	Campimetry Instruction on how to use the colorboy	Alpha omega/ mu upsilon
4	Campimetry Tootie launcher catch	Reduction Moro, walk to and fro. With anti-suppression
5	Campimetry Biopter booklet BI and BO	Read with prescription using bar reader
6	Campimetry	Body code 1 & 2
7	Van Orden star Tootie launcher red and blue	Marsden ball and VMT bat 0I0 four rows BO
8	Biopter ball and pointers	Stretch eye muscles all directions Fusion circles big and small (alternate) Eyes tracing objects

BOB visits Henk for check-up.

Henk speaks: I'm very pleased. More relaxation in the system, remove prism in OS. Plus is needed but also evokes exo, so: train with the plus.

We continue VT after summer break.

Session	In office	VT home
9	Talk about Henk's findings	Brock string with plus 1.00 Body code 3 Saccades with metronome
10	Cheiroscopy	Wieners crawl Saccades far and near Fusion chard BI
11	Bernell vecto family	Clap and stump and read Hart chart alternate far and near 1 to 20 peripheral task
12	Trampoline clap and move arms	Visualisation maze Fusion rings, small, with plus Optomatters Opt LC2 move to and fro
13	Bernell vecto jump ductions	Rope (Brock string – no beads) Trombone with plus Zoo 1 Vision star saccades
14	Biopter booklet BI and BO	Balance aeroplane and read (anti-suppression) Stretch eye muscles Use bar reader (with plus 1.00)
15	Biopter pointers	Four corner fixations

		Alternate BI and BO on fusion rings chart Marsden ball circle around you, throw and catch
16	Tootie launcher	Optomatters LC1 and 2 alternate Read moving book, plus and bar reader Alternate BI near BO far
17	Biopter booklet BI and BO Visualisation: mirrored shapes Fusion with loose prisms Zoo 2 BI and BO	

A third visit to Henk. He advises new glasses for working on the computer (plus and prism). BOB finds it hard to choose a strategy there: either pulls on tight or lets go. And he would like to see a stronger SILO response. He advises home training as BOB moved to another part of Holland.

BOB's view of the visual training

Before I went to see Henk for the first time, I was a fearful and insecure person. I was always keeping myself as safe as possible, as anyone does. Only my way of doing that cost me a great deal of energy every day. When I was 23, I was at the end of my willpower to live my life this way. I was facing a very high wall. Something needed to change.

When we started VT after my trip to South Africa, I also started syntonics. I kept a journal with sensations I experienced during syntonics. When I first started with syntonics, I had sweaty palms, a churning stomach and I was tense with the green filter. This went away after a week.

After one week with my new purple filter, I got really ill. I couldn't remember the last time I was so ill. I called Ciska and she told me that this could happen and I should start again with syntonics after I felt better.

After that, I started VT. I remember a specific day, when I drove to Heemstede in my car. I took a right turn and I realised I didn't check three times if a bicycle was approaching. I saw, I knew and I acted.

Astonished I arrived at Ciska's and I told her this story. From this day forward I reclaimed my safety, my place in this world. I knew that I knew. I now have my basic safety, my foundation, I always know what to do. I met my true self, this is me.

What if? I think about this a lot. What if I went to Ciska when I was 8? I would have spared myself from a lot of fear, anxiety and missing out, because I didn't trust myself with doing things (as simple as answering the phone). What if I never went to Ciska? I almost don't want to think about that. I have learned so much about who I truly am and I'm still learning every day at age 26.

I became an orthopedagoog, because I wanted to help children to develop to their full potential. I have always been fascinated by developing children and their cognitive abilities and behaviour. I got my master's degree and after that I fell into the world of visual training. The workshops Ciska gave, made perfect sense to me and felt very logical. These are the reasons why I chose this path. I want to help people to find their true self and their potential with visual training.

Quote: Action without vision is a nightmare

Vision without action is a daydream

This second line applied to BOB.

Attachments BOB

voornaam BOB
achternaam
adres
woonplaats
controle Datum
client nr
behandelcode vo VO
behandel datum vo 26-7-2013
geboortedatum

habituele forie

hab forie ver 3
hab forie nabij 8
eso -/exo+

objectieve refractie

skia ver od/os	-0,25	-0,25
skia midden od/os		
skia nabij od/os	0,50	0,25

subjectieve refractie

ref ver mono od	0,00	-1,25	8	6/6
ref ver mono os	0,00	-1,25	170	6/6
				6/6
ref ver bin od	0,25			
ref ver bin os	0,25		6/6 balans	6/ 6
ref max od	0,00			6/6
ref max os	0,00			6/6
				6/5 +4

forie ver

forie ver 3 tov

ducties ver

bo ver 8 / 12 / 1
bi ver 10 / 2
silo ver mp ◉ ja ○ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 1 up os
down /
up /

acc conv relatie

forie nabij 9
od 1,25 os 1,25
forie diss cros 16
cross od 1,00
forie cross 13

ductie 's nabij

tov

bo blur /break/rec	4	/ 13	/ 0
bi blur/break/rec	11	/ 24	/ 19

silo nabij mp ◉ ja ○ nee
vc ◉ ja ○ nee
hyperforie nabij 1,5 UP OS

accommodatie

tov 7balans

acc amp	5,00	6/ 6
pos rel acc	-1,25	> tov 7balans
neg rel acc	0,75	

binoculairiteit

	stereo ver	stereo nabij
perif	0	3
centraal	3	6

	mp		vc	
pola ver	◉ ja	○ nee	○ ja	○ nee
pola nabij	◉ ja	○ nee	○ ja	○ nee

nieuw voorschrift

0,75 -1,25 8 ^
0,75 -1,25 170 ^

P.D. 65,5 add 0,00

Habitueel

-0,25	-1,50	8	1,25 ^	nas
-0,50	-1,50	170	0,50 ^	nas

add

voornaam	BOB	adres	
achternaam		woonplaats	

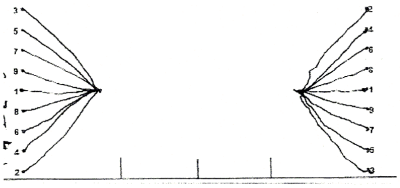
client nr

behandelcode vo VO

behandel datum vo 26-7-2013

scanner

vo star



ocf oct

vo r perif contr. 4

vo l perif contr. 4

vo symmetrie r=l

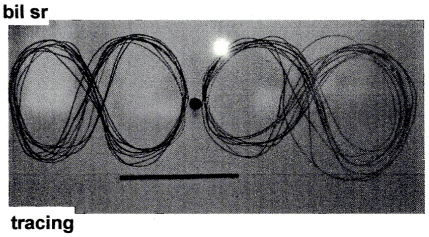
vo rechts eso/exo x

vo links eso/exo x

vo supp od os

opm ocf/sr

bil sr



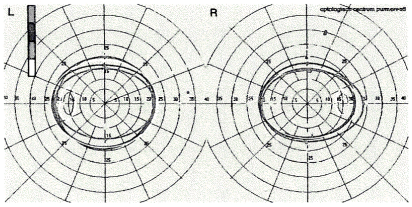
tracing

bil sr rl r=l

bil sr Q recht 4

bil sr Q links 4

syntonics veldmeting



beoordeling synt veld 4

analyse synt veld redelijk

eenzijdige lich reflex **reflex nog aanwezig**

kruispatroon ◉ **kruisganger** ○ **telganger**

preferentie hand ○ **rechts** ◉ **links**

duim oppositie ○ **rechts** ◉ **links**

preferentie oog ◉ **rechts** ○ **links**

preferentie oor ○ **rechts** ◉ **links**

preferentie been ○ **rechts** ◉ **links**

Yoked/Tooties

motoriek integr visueel reactie **matige**

corrigeren **goed**

leren **goed**

reflex tandemloop ● 0 ○ 1 ○ 2 ○ 3 ○ 4

reflex fogloop ● 0 ○ 1 ○ 2 ○ 3 ○ 4

reflex stnr ● 0 ○ 1 ○ 2 ○ 3 ○ 4

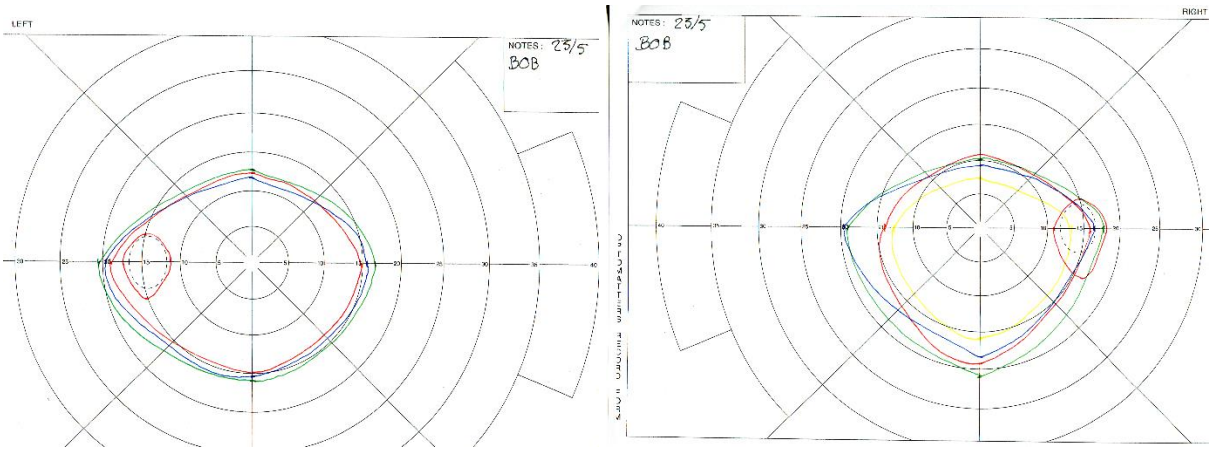
>7,5 jaar **0 optimaal - 4 max problemen**

reflex atnr	● 0	○ 1	○ 2	○ 3	○ 4
reflex tlr	● 0	○ 1	○ 2	○ 3	○ 4
reflex moro	○ 0	○ 1	○ 2	○ 3	○ 4
reflex spinale galant	● 0	○ 1	○ 2	○ 3	○ 4
angels in the snow	○ 0	○ 1	○ 2	○ 3	● 4

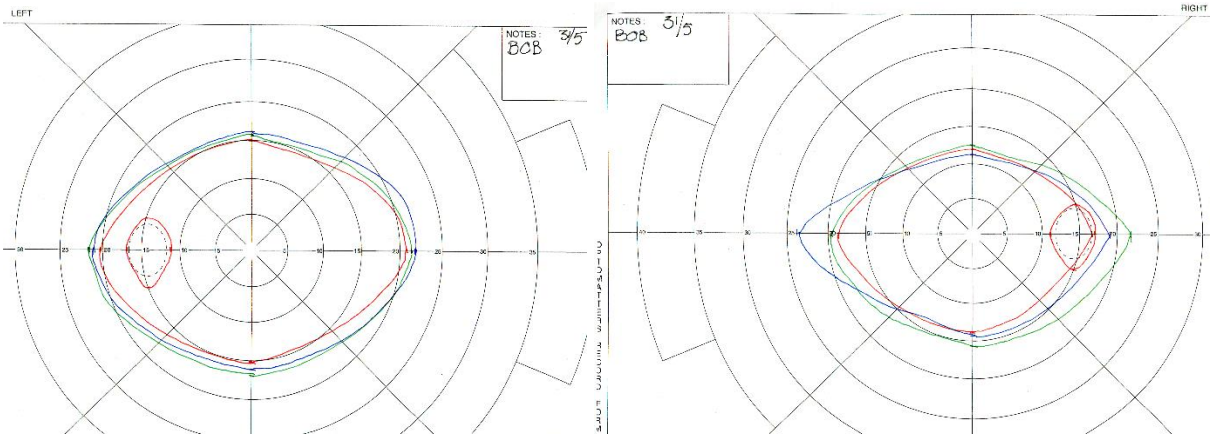
a/s: 1= monolateraal
2= homolateraal
3= ipsilateraal
4= contralateraal

tijd	**12**
aantal x	**1**
ritme	**180 p/m**
aantal x ritme	**0**
ww verb inst	**4**

Campimetry May 23rd

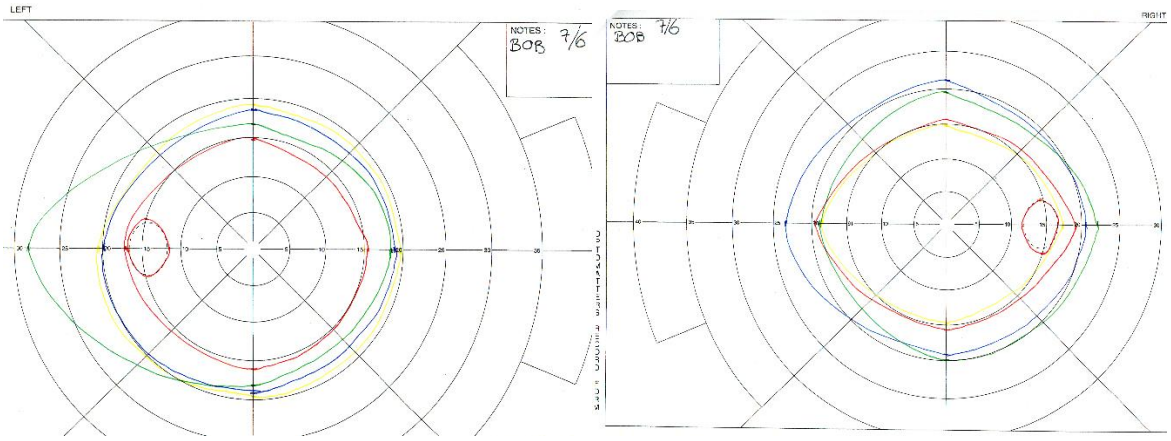


Campimetry May 31st

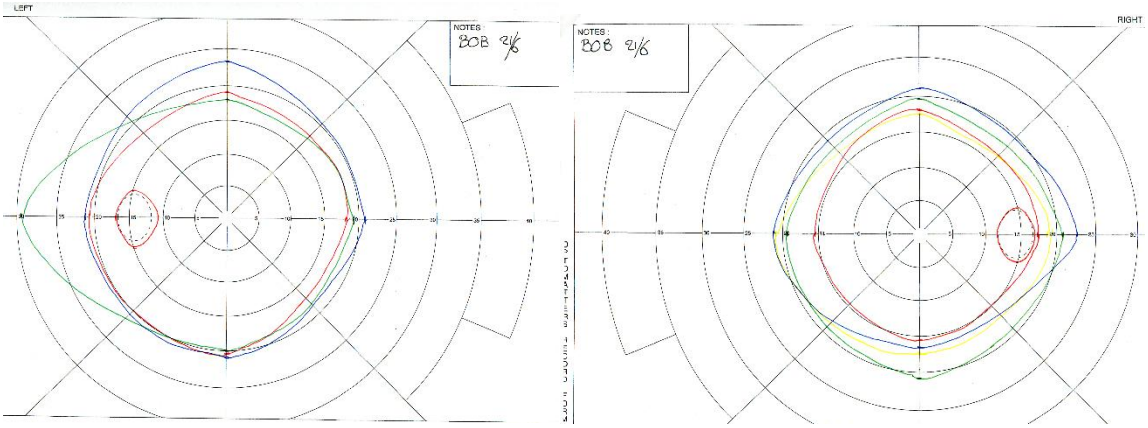


Note: I changed alpha/omega into omega N, because I wanted a change in field size. This was the breakthrough for BOB, as she experienced it.

Campimetry June 7th



Campimetry June 21st



voornaam BOB | adres | client nr
achternaam | woonplaats | behandelcode vo VC
controle Datum | behandel datum vo 23-7-2014
geboortedatum

habituele forie

hab forie ver 2 eso -/exo+
hab forie nabij 8

objectieve refractie

skia ver od/os 0,00 -0,25
skia midden od/os
skia nabij od/os 0,75 0,75

subjectieve refractie

ref ver mono od	0,25	-1,25	8	6/6	
ref ver mono os	0,25	-1,25	165	6/6	
				6/5	+3
ref ver bin od	0,75				
ref ver bin os	0,50		**6/6 balans**	6/	
ref max od	0,75			6/	
ref max os	0,50			6/	
				6/4	-1

forie ver

forie ver 3 tov

ducties ver

bo ver 8 / 30 / 13
bi ver 8 / 3
silo ver mp ◉ ja ○ nee vc ◉ ja ○ nee

hyperforie ver

hyperforie ver 1 up os
down /
up /

acc conv relatie

forie nabij 9
od 1,25 os 1,00
forie diss cros 13
cross od 0,75
forie cross 10

ductie 's nabij

tov

bo blur /break/rec 18 / 26 / 16
bi blur/break/rec 18 / 28 / 15
silo nabij mp ◉ ja ○ nee
vc ◉ ja ○ nee
hyperforie nabij 0

accommodatie

tov 7balans

acc amp 7,00 6/ 6
pos rel acc -1,75 > tov
neg rel acc 1,00

binoculairiteit

stereo ver		stereo nabij	
perif	3	perif	3
centraal	5	centraal	6

	mp		vc	
pola ver	◉ ja	○ nee	○ ja	○ nee
pola nabij	◉ ja	○ nee	○ ja	○ nee

nieuw voorschrift

0,75 -1,25 8 ^
0,50 -1,25 165 ^

P.D. 65,5 add 0,00

Habitueel

0,75 -1,25 8 ^
0,75 -1,25 170 ^
add 0,00

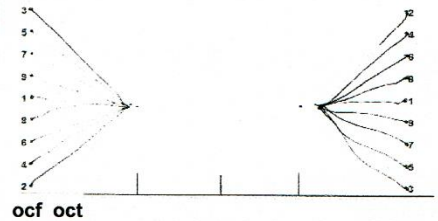
voornaam BOB adres client nr

achternaam woonplaats behandelcode vo VC

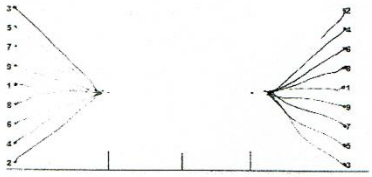
behandel datum vo 23-7-2014

scanner

vo star



ocf oct



bil sr

vo r perif contr. 5

vo l perif contr. 5

vo symmetrie r=l

vo rechts eso/exo x

vo links eso/exo x

vo supp od os n.v.t.

opm ocf/sr ocf is zonder bril

bil sr rl

bil sr Q recht

bil sr Q links

tracing

syntonics veldmeting

beoordeling synt veld

analyse synt veld

preferentie hand ○ rechts ○ links

duim oppositie ○ rechts ○ links

preferentie oog ○ rechts ○ links

preferentie oor ○ rechts ○ links

preferentie been ○ rechts ○ links

eenzijdige lich reflex

kruispatroon ○ kruisganger ○ telganger

motoriek integr visueel reactie

corrigeren

leren

Yoked/Tooties

reflex tandemloop ○0 ○1 ○2 ○3 ○4

reflex fogloop ○0 ○1 ○2 ○3 ○4

reflex stnr ○0 ○1 ○2 ○3 ○4

>7,5 jaar

0 optimaal

- 4 max

Chapter 7

"The old King felt refreshed, clear-headed, almost ready to begin again.

There would be a day – there must be a day – when he would come back to Gramarye with a new Round Table which had no corners, just as the world had none – a table without boundaries between the nations who would sit to feast there. The hope of making it would lie in culture. If people could be persuaded to read and write, not just to eat and make love, there was still a chance that they might come to reason.

But it was too late for another effort then. For that time it was his destiny to die, or, as some say, to be carried off to Avilion, where he could wait for better days. For that time it was Lancelot's fate and Guenever's to take the tonsure and the veil, while Mordred must be slain. The fate of this man or that man was less than a drop, although it was a sprakling one, in the great blue motion of the sunlit sea.

The cannons of his adversary were thundering in the tattered morning when the Majesty of England drew himself up to meet the future with a peaceful heart."

So: what went wrong? Why do we all fail to use our full potential? Or get there in the end?

My TAO-teacher uses this description: 'We are damaged miracles' and so true that is.

Life is the miracle and yet it also leaves us scarred. By adapting to survive, by adapting to our families, we lose parts of our capacities. Or rather: we seem to not develop into the full potential and we stop using bits and pieces of it.

Maybe Hamlet did not mean 'a' man, but 'man' as in mankind. Like we all - as a group - are the potential.

But Leonardo da Vinci seems to come close to undamaged miracle, all in one person. Michael Gelb wrote a great book: ' How to think like Leonardo da Vinci'. It teaches you at least some techniques for becoming a genius.

What we miss is the magician. We need Merlins. We need educators like him.

And we know a few: how about Skeffington, Jerry Getman, John Hanson and Harry Wachs?

I have come to the conclusion that while working in Behavioural Optometry, we will be Merlins in the lives of others. There is magic in this work. So I want pass it on, to the next generation.

I must admit: it felt like the refreshed king, writing this. Receiving so much inspiration out of making this thesis. I would really love to start all over again.

But BOB has the candle now.

Thanks BOB and good luck to you.

Attachment 1

Beter kijken door spelen

Rob J. Th. Gevers, BOptom

KEYWORDS

Visual development, oculomotor control, visual skills, motor development and learning.

INLEIDING

Naar aanleiding van de resultaten van eerder onderzoek (Driessen, 2008) naar de relatie tussen motorische ontwikkeling en leren is door Thea van Eijk-Looijmans van 'Spelen Moet!', de interventie 'Beter Leren Door Spelen' ontwikkeld. In de pilotfase van deze interventie is onder leiding van prof. dr. Anna Bosman van de Radboud Universiteit Nijmegen een studie verricht naar de effecten van doelgericht spelen en actief zijn in het dagelijks leven op de ontwikkeling van de motoriek, visuele vaardigheden en het zelfgenererend leervermogen van kinderen. In de huidige leefomgeving van (jonge) kinderen is er in toenemende mate sprake van bewegingsarmoede. Door het intensief gebruiken van moderne technologieën zoals game boys, computers, DVD en televisie ontvangen jonge kinderen steeds minder prikkels om in een natuurlijke driedimensionale ruimte te bewegen en te spelen. De hypothese is dat wanneer kinderen onvoldoende spelen en zelf actief zijn, veel basisvaardigheden die voor het leren essentieel zijn onvoldoende worden ontwikkeld. In 2009 bleek slechts 21% van de jongens en 26% van de meisjes tussen de 4 en 17 jaar te voldoen aan de Nederlandse Norm Gezond Bewegen (Tuil, 2009). Spelen en bewegen zijn naast het ontwikkelen van motorische en sensorische vaardigheden ook onlosmakelijk verbonden bij de ontwikkeling van het visuele systeem (Ruijssenaars, 2005). In deze studie is dus niet alleen gekeken naar de motorische ontwikkeling en cognitieve vaardigheden van de kinderen, maar ook naar de ontwikkeling van motorische en sensorische visuele vaardigheden. Visuele vaardigheden zijn ondermeer: oculaire motiliteit, vergentie en accommodatie. Samen zijn zij verantwoordelijk voor een efficiënte visuele waarneming. In dit artikel komen met name de optometrische onderzoeksmethoden en de uitslagen van de testen aan bod.

In januari 2010 zijn optometristen van de OVN vakgroep Binoculair Zien (BZ) benaderd om het visuele deel van de studie voor hun rekening te nemen. BZ optometristen houden zich intensief bezig met het onderzoek naar oogsamenwerking met de bijbehorende klachten of stoornissen. Dit kunnen o.a. asthenope klachten, lees- en leerstoornissen, concentratiestoornissen en lichamelijke balansklachten zijn. Aangezien kinderen met lees- en leerstoornissen een belangrijk deel van de cliënten van BZ optometristen vormen, waren de BZ optometristen onmiddellijk geïnteresseerd om aan het onderzoek deel te nemen. In de dagelijkse praktijk ervaren zij vaak de samenhang van motorische ontwikkeling en visuele ontwikkeling (Eijk, 2008).

OPTOMETRISCHE ONDERZOEKSHYPOTHESE

De hypothese die getoetst zal worden, luidt als volgt:

De visuele vaardigheden van de kleuters uit de experimentele groep gaan significant meer vooruit dan de visuele vaardigheden van de kleuters uit de controlegroep.

Voor het toetsen van deze hypothese zijn de scores geanalyseerd aan de hand van de non-parametrische hiërarchische, meervoudige regressieanalyse met interactie en logistische regressie en de non-parametrische Kruskal Wallis toets. De resultaten zijn weergegeven in tabel 1 en zijn uitgesplitst naar de aard van de toets, parametrisch (a) en non – parametrisch (b). Aangezien het interactie-effect voor geen van de variabelen significant bleek te zijn, zijn in tabel 1 slechts de statistieken behorend bij de hoofdeffecten gerapporteerd.

Het is van belang om te vermelden dat de scores op de refractiemetingen niet voldoende normaal verdeeld waren. Alvorens over te gaan op de analyses, zijn die scores daarom getransformeerd middels de zogenaamde inverse-transformatie. Dat houdt in dat voor alle scores de volgende berekening is gemaakt: -1 / (score). De getransformeerde scores zijn vervolgens gebruikt voor de statistische analyses.

METHODEN

Bij de nulmeting van september 2010 zaten de kinderen van zowel de onderzoeksgroep als die van de controlegroep in groep 2 van de basisschool. De onderzoeksgroep bestond uit 71 kinderen waarvan 42 jongens en 29 meisjes. In de controlegroep zaten 33 kinderen waarvan 17 jongens en 16 meisjes. De controleschool was zo gekozen dat beide scholen vergelijkbaar waren. De nameting vond plaats in mei 2011.
De interventie bij de experimentele groep bestond uit het stimuleren van spelen en bewegen. In het lesprogramma van de experimentele school werd tijd ingeruimd voor spelen en bewegen en werden de ouders via de digitaal aangeboden leergang voortdurend geprikkeld om hun kinderen te laten spelen en bewegen (Maas, 2011).
Bij deze jonge kinderen tussen de 5 en 6 jaar was het moeilijk om een valide optometrische testprocedure vast te stellen. Kinderen van die leeftijd geven nog geen betrouwbare feedback waardoor subjectieve visuele metingen nog erg lastig zijn. Daarom is voor vier objectieve metingen en observaties gekozen, passend bij de leeftijd van de kleuters. Gezien het grote aantal kinderen mocht om praktische en organisatorische redenen de testprocedure niet langer dan 10 minuten duren. Een testduur van 10 minuten past ook beter bij de concentratieboog van kinderen van deze leeftijd. De testen die werden afgenomen waren: visus en refractie, Near Point of Convergence (NPC), Oculaire motiliteit, Tooties® test.
De verschillende testen zijn in protocollen beschreven en door de zes deelnemende optometristen gedurende een trainingsdag besproken en geoefend.

Visus

Voor het opnemen van de visus is voor het gebruik van de 'Fonda Anderson Reading Chart' gekozen. Deze nabij test is bij jonge kinderen sneller en eenvoudiger uit te voeren dan een test op een grotere afstand en geeft toch een redelijke indruk van de visus.

Omstandigheden: klaslokaal met een combinatie van daglicht en TL licht. Er werd eerst monoculair getest en daarna binoculair.

Refractie
De refractiemetingen zijn gedaan met Nidek autorefractometers welke door Holland Optical Instruments ter beschikking zijn gesteld.

NPC
Omstandigheden: verlichting normaal.
Fixatie object: Wolfwand. Dit is een stokje met op het uiteinde een spiegelbolletje. Laat het kind iets onder ooghoogte op het object fixeren. Controleer of hij het object waarneemt. Vraag om aan te geven wanneer het bolletje dubbel wordt gezien. Noteer het subjectieve en objectieve breek en herstelpunt. Herhaal deze procedure 5 x om te kijken of er uitputting optreedt.

Oculaire motiliteit
Bij dit onderzoek van de oogbewegingen is er naast het screenen van een mogelijke pathologische bewegingsbeperking vooral gekeken naar een functionele bewegingsbeperking. Dat wil zeggen: welke vaardigheid bezit het kind om een fixatieobject te volgen.
Voor dit onderdeel is gekozen voor de NSUCO Oculomotor test. Deze gevalideerde test is ontwikkeld door prof. W.C. Maples van de Oklahoma State University, College of Optometry (Maples, 1995). De test wordt als volgt uitgevoerd: staand, voeten op schouderbreedte uit elkaar en recht voor de onderzoeker. Er wordt aan de kinderen geen instructie gegeven of er met het hoofd bewogen mag worden.
Fixatie object: Wolfwands, (zilver en goudkleurig bolletje) of pen pal fixations, (pen met een diertjesfiguur), één voor de pursuits en twee voor de saccaden.
De Saccaden (sprongbewegingen) worden alleen in de horizontale meridiaan uitgevoerd, waarbij het kind 3 x heen en weer kijkt. De Pursuits (volgbewegingen) worden cirkelvormig uitgevoerd, driemaal met de klok mee en driemaal tegen de klok in. De cirkels moeten ongeveer 20 cm in diameter zijn met het centrum van de cirkel gericht op de neusbrug van het kind.

De metingen werden als volgt genoteerd:
Ability is het vermogen om de test te kunnen uitvoeren, dus hoe vaak kan er van links en naar rechts gekeken worden zonder de fixatie te verliezen.
Accuracy: hoe nauwkeurig wordt er gefixeerd.
Movement: kan er gefixeerd worden zonder hoofd of lichaam te draaien.

Tootiestesten
Tot slot zijn drie testen van een Tootiestest® (Eijk 2010) afgenomen. De eerste set bestond uit het vijf keer gooien van een Tootie (soort hightech pittenzakje) tegen de zogenoemde Tootie Toss. Het was de bedoeling dat de kleuters een Tootie tegen het verende net mikten en de terugkaatsende Tootie probeerden op te vangen. De tweede test was vergelijkbaar met de eerste reeks, maar de kleuter droeg nu een prismabril. Door de prismabril werd het beeld verplaatst. De derde test was exact hetzelfde als de eerste reeks dus nu weer zonder prismabril. Zodra de prismabril werd opgezet, veranderden de omstandigheden voor de ogen en zodra die weer werd afgezet, veranderden die omstandigheden nogmaals. In deze test is zowel gekeken naar de pure

prestaties op de visueel-motorische taak, als naar de snelheid waarin een visueel-motorische taak weer correct uitgevoerd kan worden nadat de (visuele) omstandigheden zijn veranderd. Bij deze testen werd bij elke poging geregistreerd of de kleuter in staat was om de Tootie tegen de Tootie Toss aan te gooien en als dat het geval was, of het lukte om de terugkaatsende Tootie weer op te vangen. Er waren dus telkens drie scores mogelijk: 0 (niet raak, niet gevangen); 1 (raak, niet gevangen); 2(raak, gevangen). Vervolgens zijn alle 15 pogingen gespiegeld en is er een productvariabele van gemaakt. Het getal van de poging (eerste poging (1); tweede poging (2); etc.) is vermenigvuldigd met de gespiegelde score (0, 1 of 2). Op basis van die nieuwe scores zijn vervolgens vier somscores berekend: een somscore voor de vijf pogingen van de eerste set (zonder prismabril); een somscore voor de vijf pogingen van de tweede set (met prismabril); een somscore voor de vijf pogingen van de derde set (zonder prismabril) en tot slot een totale somscore voor de 15 pogingen bij elkaar. Door de prestaties op deze manier weer te geven is het mogelijk om tegelijkertijd een uitspraak te doen over de prestatie op de taak en over de snelheid waarmee de taak weer correct kan worden uitgevoerd nadat de omstandigheden zijn veranderd. Kortom: de prestaties zijn zodanig weergegeven dat daarvoor geldt hoe hoger de score, hoe beter en hoe sneller.

RESULTATEN/DISCUSSIE

Visus: Er is gebleken dat de experimentele groep op zowel 'visus rechteroog', 'visus linkeroog' als 'visus beide ogen' significant vooruit is gegaan tussen de voormeting en de nameting (H = -4.30, p < .01; H = -4.32, p < .01; H = -3.92, p < .01). De controlegroep is slechts op 'visus beide ogen' significant vooruit gegaan tussen de voormeting en de nameting (H = -3.37, p = .01). Dat wil zeggen dat de kleuters uit de experimentele groep significant meer vooruit zijn gegaan wat betreft 'visus rechteroog' en 'visus linkeroog' dan de kleuters van de controlegroep (tabel 2).

Refractie: Op geen van de refractiemetingen is er een significant verschil gevonden tussen de experimentele groep en de controlegroep (p's> .05). Uit onderzoek (Harrison, 2004) blijkt dat de metingen met autorefractors betrouwbaar zijn. In de dagelijkse praktijk wordt bij kinderen van deze leeftijd een refractie gedaan onder cycloplegie. Bij het screenen van grote groepen is dit echter erg tijdrovend en bovendien is het een ingrijpende ervaring en belastend voor de kinderen. Het doel van de meting was niet het vaststellen van de exacte refractieafwijking maar om vast te kunnen stellen of er een patroon was in refractieverandering tussen de beide groepen (tabel 2).

NPC: De kleuters van de experimentele groep blijken niet significant meer vooruit te zijn gegaan dan de kleuters van de controlegroep op het breekpunt (zowel objectief als subjectief gemeten) en het herstelvermogen van de ogen (p's > .05). Wat betreft de uitputbaarheid van de ogen is uit de logistische regressie het volgende gebleken. De waarschijnlijkheid dat de kleuters uitputbaar zijn (vs. niet uitputbaar) op de nameting, is 2,6 maal zo groot voor kleuters die op de voormeting uitputbaat waren, dan voor kleuters die op de voormeting niet uitputbaar waren. Dat zegt echter weinig over het verschil tussen de experimentele groep en de controlegroep. Daarvoor is het volgende gebleken. Gecorrigeerd voor de voormeting uitputbaarheid, geldt dat de waarschijnlijkheid om op de nameting uitputbaar te zijn (vs. niet uitputbaar) ruim vier maal zo klein (0,234) is voor kleuters van de experimentele groep dan voor kleuters van de controlegroep. Dat verschil is significant te noemen, p = .01 (tabel 2).

Oculaire motiliteit: De kleuters van de experimentele groep blijken op alle vaardigheidsscores van oogsprongen en volgbewegingen significant vooruit te zijn gegaan tussen de voormeting en de nameting (H = -5.83, p < .01; H = -4.70, p < .01; H = -2.85, p < .01; H = -3.41, p = .01; H = -3.43, p < .01; H = -3.38, p < .01). De kleuters van de controlegroep zijn daarentegen alleen vooruit gegaan op de vaardigheidsscore 'oogsprong mogelijkheid' (H = -3.25, p < .01). Hier blijkt dat de ontwikkeling van algemene motoriek een positieve invloed heeft op de visuele motoriek (tabel 2).

Tooties: De experimentele groep blijkt significant meer vooruit te zijn gegaan dan de controlegroep op zowel de afzonderlijke somscores van drie sets als de totale somscore van de Tootiestesten (t = 3.09, p < .01; t = 2.01, p = .04; t = 3.65, p < .01; t 3.30, p < .01). Dat wil zeggen dat de kleuters uit de experimentele groep zowel beter presteerden als zich sneller aan konden passen aan veranderende visuele omstandigheden dan de controlegroep (tabel 2).

CONCLUSIE

Uit het onderzoek is gebleken dat de experimentele groep significant meer vooruit is gegaan dan de controlegroep op de gebieden fijne motoriek, de visus van zowel het linker- als het rechteroog, de uitputbaarheid van het convergentiesysteem, het maken van oogsprongen, het maken van visuele volgbewegingen en tot slot de mogelijkheid tot aanpassing na veranderde visuele omstandigheden (Maas, 2011). Hieruit blijkt dat het op jonge leeftijd actief stimuleren van bewegen en spelen een positief effect heeft op de ontwikkeling van visuele vaardigheden. De deelnemende partijen in deze studie hebben de wens uitgesproken om dezelfde studie te herhalen bij iets oudere kinderen. Met name het objectief vaststellen van optometrische criteria is beter en betrouwbaarder bij iets oudere kinderen.

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AMERICAN ACADEMY™ OF OPHTHALMOLOGY

Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050

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Purpose: Myopia is a common cause of vision loss, with uncorrected myopia the leading cause of distance vision impairment globally. Individual studies show variations in the prevalence of myopia and high myopia between regions and ethnic groups, and there continues to be uncertainty regarding increasing prevalence of myopia.

Design: Systematic review and meta-analysis.

Methods: We performed a systematic review and meta-analysis of the prevalence of myopia and high myopia and estimated temporal trends from 2000 to 2050 using data published since 1995. The primary data were gathered into 5-year age groups from 0 to ≥100, in urban or rural populations in each country, standardized to definitions of myopia of −0.50 diopter (D) or less and of high myopia of −5.00 D or less, projected to the year 2010, then meta-analyzed within Global Burden of Disease (GBD) regions. Any urban or rural age group that lacked data in a GBD region took data from the most similar region. The prevalence data were combined with urbanization data and population data from United Nations Population Department (UNPD) to estimate the prevalence of myopia and high myopia in each country of the world. These estimates were combined with myopia change estimates over time derived from regression analysis of published evidence to project to each decade from 2000 through 2050.

Results: We included data from 145 studies covering 2.1 million participants. We estimated 1406 million people with myopia (22.9% of the world population; 95% confidence interval [CI], 932–1932 million [15.2%–31.5%]) and 163 million people with high myopia (2.7% of the world population; 95% CI, 86–387 million [1.4%–6.3%]) in 2000. We predict by 2050 there will be 4758 million people with myopia (49.8% of the world population; 3620–6056 million [95% CI, 43.4%–55.7%]) and 938 million people with high myopia (9.8% of the world population; 479–2104 million [95% CI, 5.7%–19.4%]).

Conclusions: Myopia and high myopia estimates from 2000 to 2050 suggest significant increases in prevalences globally, with implications for planning services, including managing and preventing myopia-related ocular complications and vision loss among almost 1 billion people with high myopia. *Ophthalmology 2016;■:1–7* © *2016 by the American Academy of Ophthalmology. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).*

Supplemental material is available at www.aaojournal.org.

In 2010, it was estimated that uncorrected refractive error was the most common cause of distance vision impairment, affecting 108 million persons, and the second most common cause of blindness globally.[1] The economic burden of uncorrected distance refractive error, largely caused by myopia, was estimated to be US$202 billion per annum.[2] There is a substantive economic argument for eliminating uncorrected myopia and other refractive errors.[3]

However, myopia brings further vision challenges because high myopia increases the risk of pathologic ocular changes such as cataract, glaucoma, retinal detachment, and myopic macular degeneration, all of which can cause irreversible vision loss.[4] In some communities with a high prevalence of myopia, myopic macular degeneration has been found to be the most frequent cause of irreversible blindness.[5] Myopic macular degeneration has been found to cause 12.2% of vision impairment in Japan (approximately 200 000 people).[6]

There remain 2 major gaps in the literature. First, individual studies suggest wide variation in the prevalence of myopia between different regions and ethnic groups.[7] For example, the prevalence of myopia is more than 2 times higher among East Asians than similarly aged white persons.[8] Second, the prevalence of myopia in different countries seems to be increasing, and most dramatically among younger people in East Asia.[8] The combination

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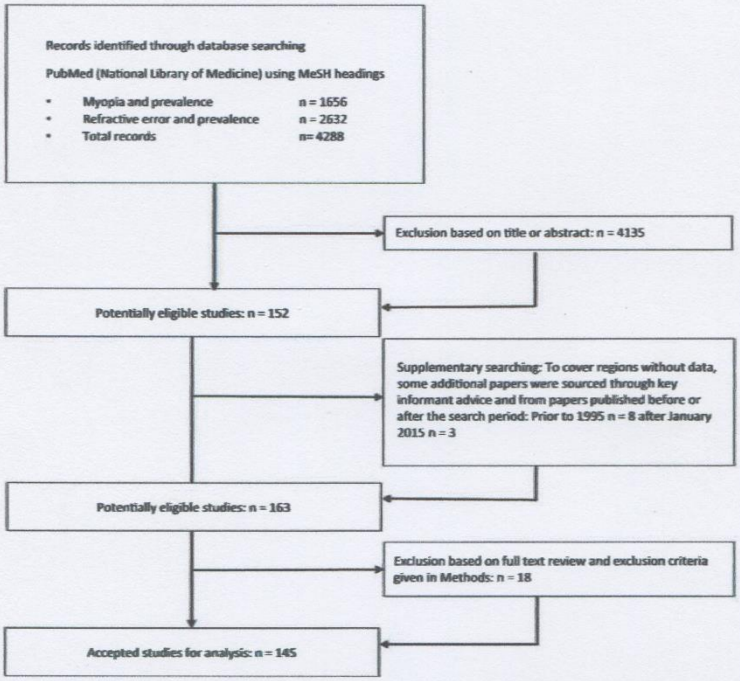

Figure 1. Flow diagram summarizing the systematic search and review process for identifying myopia prevalence evidence globally. MeSH = medical subject headings.

of vision impairment from uncorrected myopia and irreversible vision loss from myopia-related complications make accurate global estimates of the prevalence and temporal trends critical for planning care and services. However, there are no precise estimates of the global prevalence of myopia or for projected temporal changes over the next few decades.

Methods

Studies, Databases, and Data Organization

We performed a systematic search and review of the prevalence of myopia and high myopia using data published since 1995, summarized in Figure 1. We searched PubMed (National Library of Medicine) on January 10, 2015, for publications using the following MeSH (Medical Subject Heading) terms: *myopia* AND *prevalence* and *refractive error* AND *prevalence*. The search was restricted to articles published after January 1, 1995, and was performed on all available articles regardless of the original language of publication. The search yielded 1656 and 2632 articles relating to myopia and refractive error, respectively. The abstract of each publication was reviewed and articles that were population-based surveys were included. Surveys were excluded if they did not specify the number of eligible participants or participation rate, or if data were from a specific population that could not be generalized to the population as a whole. We rejected 8 articles that did not specify a definition of myopia. To cover regions without data, some additional articles were sourced through key informant advice and from reference lists of articles found through PubMed. A full list of the 145 studies is included in Appendix 1 (available at www.aaojournal.org).

Country-specific population data for each decade from 2000 through 2050, in 5-year age groups from 0 to ≥100, were drawn mostly from the United Nations World Population Prospects.[9] Population data from the United States Census Bureau were used for a small number of low-population states omitted from the available United Nations data.[10]

Studies have suggested that myopia rates differ in urban compared with rural communities that are otherwise similar.[11,12] We therefore obtained separate urban and rural myopia prevalences where possible and disaggregated country-level populations into urban and rural numbers sourced from the United Nations World Urbanization Prospects.[13]

Countries were grouped into the 21 Global Burden of Disease (GBD) regions.[1] The country-specific urban and rural population data were combined with the corresponding prevalence data in each 5-year age group to calculate the number of people with

myopia. The numbers of people with myopia in each age group in rural and urban areas of each country then were aggregated to obtain regional totals.

Definitions

The definitions of myopia and high myopia vary across the selected prevalence studies. Of the 145 articles included in this study, the most common definition of myopia was spherical equivalent of −0.50 diopter (D) or less (58.7%), with 29.0% using less than −0.50 D, 5.0% using −1.00 D or less or less than −1.00 D (all studies of adults), 2.9% using −0.75 D or less or less than −0.75 D, and 3.6% using −0.25 D or less or less than −0.25 D. Only 59 studies defined and measured high myopia, with 30.5% defining it as −6.00 D or less, 30.5% defining it as less than −6.00 D, 35.6% defining it as −5.00 D or less or less than −5.00 D, 1.7% defining it as −8.00 D or less, and 1.7% defining it as −3.00 D or less.

We standardized to a spherical equivalent of −0.50 D or less for myopia because it was the most commonly used definition in published prevalence studies, is beyond refraction measurement error, and captures children at the start of their progression. We standardized to a spherical equivalent of −5.00 D or less for high myopia because it is used commonly, identifies people at higher risk of pathologic myopia, and if uncorrected, causes vision impairment at least equivalent to the World Health Organization–defined blindness.[14]

The relationship between prevalence and definition was analyzed using all articles providing prevalence at 2 or more cut-offs for myopia or high myopia. All prevalence data were standardized to myopia and high myopia definitions of −0.50 D or less and −5.00 D or less, respectively, using linear regressions specific to regional and dioptric level (see Supplemental Material, part 1, available at www.aaojournal.org).

Meta-analysis and Extrapolation

Meta-analysis of the prevalence of myopia and high myopia within each age group of each GBD region, using the standardized myopia definitions and a standardized time point of 2010, was performed using Comprehensive Meta-Analysis software version 3 (Biostat, Englewood, NJ). A logit random effects model was used to combine studies within each age group and region. The logit prevalence was defined as $\log(p/(1-p))$, where p is the prevalence within each age group. The study-to-study variance (τ^2) was not assumed to be the same for all age groups within the region, indicating that this value was computed within age groups and was not pooled across age groups. The inverse of the variance was used to compute relative weights. The logit prevalence and its standard error were used to compute the 95% confidence limits, which then was transformed to the estimated prevalence and its corresponding limits using the formula $E^{\wedge}(\text{logit prevalence})/(E^{\wedge}(\text{logit prevalence})+1)$, where E = Euler's number.

Age-specific regional meta-analysis results were extrapolated to GBD regions lacking data in any specific age or urbanization group, with extrapolations based on regional similarities in urbanization, Human Development Index (HDI), racial profiles, culture, education systems, health systems, and other similarities.[15] Data gaps within regions also were filled via nearest neighbor linear interpolation between age groups up to a maximum of 20 years between groups.

Projections across Decades

Longitudinal and repeated cross-sectional studies have shown increasing prevalence of myopia.[16–21] We analyzed change in myopia prevalence over time against prevalence of myopia ($R^2 = 0.86$), rate of urbanization ($R^2 = 0.07$), and change in HDI ($R^2 = 0.69$). The relationship between change in myopia over time and prevalence of myopia was the strongest, following the formula:

$$\text{Percentage annual prevalence change} = 12.456 \times E^{\wedge}(-0.04 \times \text{prevalence}) - 0.22813,$$

where E = Euler's number. There were 2 exceptions to using this percentage annual change formula. First, because there were no data for prevalence less than 28.3%, we took the conservative approach of using a constant 3.8% change/year for all prevalences less than 28.3%. Second, Vitale et al[16] provide a clear indication that the effect decreases at ages younger than 20 years. Fitting a 2-part linear function to their data suggested adjusting the calculated annual change in myopia figure by a factor of 0.5 in the 10- to 19-year-old age groups, 0.25 in the 5- to 9-year-old age group, and 0 in the 0- to 4-year-old age group. The prevalence of myopia in each decade was calculated by adjusting the prevalence figure by a cumulative change equal to Prevalence × (1 + (Percentage annual change)^(number of years)).

Three studies showed a similar increase in prevalence of high myopia over time. Given the sparse data, we used a simple average annual prevalence change from these studies (3.26% per year).[16–18] Additionally, because the evidence trended to less annual change as prevalence increased between 15% and 30% and there was no annual change data for high myopia prevalence of 30% or more, we generated a logarithmic decay function that reduced to 0 when the prevalence reached 100%. This formula was used when the prevalence of high myopia was more than 30%:

$$\text{Annual change} = -2.237 \times \ln(\text{prevalence}) + 10.283,$$

where $\ln$ = natural log. Data from Vitale et al[16] again suggested that the annual change in high myopia prevalence would be less in age groups younger than 20 years. Using a similar process as in the myopia case, the annual change in high myopia prevalence was adjusted by a factor of 0.4 in the 15- to 19-year-old age group, 0.3 in the 10- to 14-year-old age group, 0.2 in the 5- to 9-year-old age group, and 0.1 in the 0- to 4-year-old age group. The changing proportion of people living in urban versus rural situations in each decade was sourced from the United Nations.[13]

Confidence Intervals

In addition to the 95% confidence limits calculated in the meta-analysis of prevalence data, uncertainty in future population projections was represented by the high- and low-fertility population projections from the United Nations.[13]

Control Factors

Published evidence indicates that myopia is common and increasing over time, with apparent effects of race, location, and generation. Racial effects were controlled by using studies as broadly representative of a country's population as possible and extrapolating within GBD regions. Location effects were controlled by disaggregating urban and rural populations and prevalence and extrapolating based on HDI and GBD region. Generational shifts were accommodated through our change over time methodology and were facilitated by maintaining 5-year age groups through to ≥100.

Results

A summary of the original data from all 145 studies is given in Appendix 2 (available at www.aaojournal.org). Figure 2 shows our estimates of the total number of people with myopia globally. In

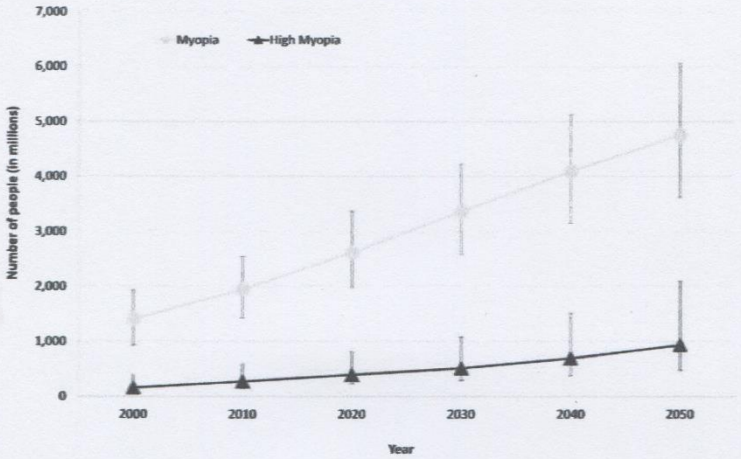

Figure 2. Graph showing the number of people estimated to have myopia and high myopia for each decade from 2000 through 2050. Error bars represent the 95% confidence intervals.

2000, this was 1406 million (22.9% of the global population; uncertainty interval, 932–1932 million [15.2%–31.5%]), increasing to 1950 million in 2010 (28.3% of the global population; 1422–2543 million [20.6%–36.9%]). This is projected to increase to 2620 million in 2020 (34.0% of the global population; uncertainty interval, 1976–3366 million [26.2%–42.6%]), to 3361 million by 2030 (39.9% of the global population; uncertainty interval, 2578–4217 million [32.3%–47.5%]), to 4089 million by 2040 (45.2% of the global population; uncertainty interval, 3145–5128 million [38.1%–52.1%]), and to 4758 million by 2050 (49.8% of the global population; uncertainty interval, 3620–6056 million [43.4%–55.7%]).

Regional differences are evident throughout the projection period, as shown in Table 1. The high-income countries of Asia-Pacific begin with a significantly higher prevalence of myopia than any other region. East Asia, Southeast Asia, and the high-income countries of North America close the gap to some extent by 2050 because of a combination of ceiling effects in some age groups, prevalence distribution across age groups, and changing age demographics.

Figure 2 shows our estimates of the total number of people with high myopia globally. This was 163 million in 2000 (2.7% of the global population; uncertainty interval, 86–387 million [1.4%–6.3%]), increasing to 277 million in 2010 (4.0% of the global population; uncertainty interval, 153–589 million [2.2%–8.6%]). This is projected to increase to 399 million in 2020 (5.2% of the global population; uncertainty interval, 233–815 million [3.1%–10.3%]), to 517 million by 2030 (6.1% of the global population; uncertainty interval, 298–1082 million [3.7%–12.2%]), to 696 million by 2040 (7.7% of the global population; uncertainty interval, 381–1518 million [4.6%–15.4%]), and to 938 million by 2050 (9.8% of the global population; uncertainty interval, 479–2105 [5.7%–19.4%]). Regional differences are evident throughout the projection period, as shown in Table 1.

Figure 3 shows the distribution of people with myopia and prevalence of myopia across age groups. In 2000, the greatest numbers of people with myopia were between 10 and 39 years of age. However, our projections suggest that through both cohort and age effects this distribution will spread by 2050, with large numbers of people with myopia from 10 years of age all the way through to 79 years of age.

Table 1. Prevalence of Myopia Estimated for Each Global Burden of Disease Region between 2000 and 2050

Region	Prevalence (%) in Each Decade					
	2000	2010	2020	2030	2040	2050
Andean Latin America	15.2	20.5	28.1	36.2	44.0	50.7
Asia-Pacific, high income	46.1	48.8	53.4	58.0	62.5	66.4
Australasia	19.7	27.3	36.0	43.8	50.2	55.1
Caribbean	15.7	21.0	29.0	37.4	45.0	51.7
Central Africa	5.1	7.0	9.8	14.1	20.4	27.9
Central Asia	11.2	17.0	24.3	32.9	41.1	47.4
Central Europe	20.5	27.1	34.6	41.8	48.9	54.1
Central Latin America	22.1	27.3	34.2	41.6	48.9	54.9
East Africa	3.2	4.9	8.4	12.3	17.1	22.7
East Asia	38.8	47.0	51.6	56.9	61.4	65.3
Eastern Europe	18.0	25.0	32.2	38.9	45.9	50.4
North Africa and Middle East	14.6	23.3	30.5	38.8	46.3	52.2
North America, high income	28.3	34.5	42.1	48.5	54.0	58.4
Oceania	5.0	6.7	9.1	12.5	17.4	23.8
South Asia	14.4	20.2	28.6	38.0	46.2	53.0
Southeast Asia	33.8	39.3	46.1	52.4	57.6	62.0
Southern Africa	5.1	8.0	12.1	17.5	23.4	30.2
Southern Latin America	15.6	22.9	32.4	40.7	47.7	53.4
Tropical Latin America	14.5	20.1	27.7	35.9	43.9	50.7
West Africa	5.2	7.0	9.6	13.6	19.7	26.8
Western Europe	21.9	28.5	36.7	44.5	51.0	56.2
Global	22.9	28.3	33.9	39.9	45.2	49.8

Numbers and uncertainty are provided in the Supplemental Material (available at www.aaojournal.org).

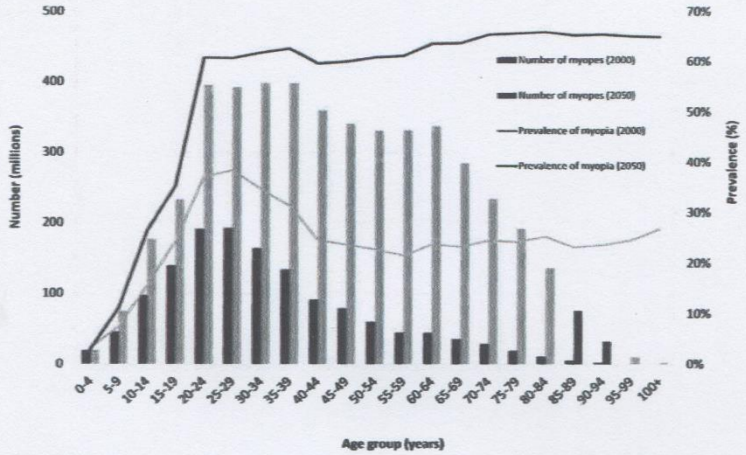

Figure 3. Graph showing the distribution of people estimated to have myopia across age groups in 2000 and 2050.

Discussion

Our study estimates that myopia and high myopia will show a significant increase in prevalence globally, affecting nearly 5 billion people and 1 billion people, respectively, by 2050. These have important implications for planning comprehensive eye care services, including refractive services such as spectacles and managing and preventing myopic-related ocular complications and vision loss among people with high myopia.

The increasing prevalence of high myopia has already been noted in some regions. Vitale et al[16] found an 8-fold increase in high myopia (≤7.90 D) over 30 years, from 0.2% to 1.6%.[16] The level of high myopia in Asian countries is considerably higher. In the study of college freshman in Taiwan by Wang et al,[19] high myopia increased from 26% of all myopia in 1988 to 40% of myopia in 2005. Lin et al[17] found that 21% of 18-year-old Taiwanese students in 2000 had high myopia (<−6.00 D) compared with 10.9% in 1983.

The projected increases in myopia and high myopia are widely considered to be driven by environmental factors (nurture), principally lifestyle changes resulting from a combination of decreased time outdoors and increased near work activities, among other factors.[22] Genetic predisposition also seems to play a role, but cannot explain the temporal trends observed over a short period.[23] Among environmental factors, so-called high-pressure educational systems, especially at very young ages in countries such as Singapore, Korea, Taiwan, and China, may be a causative lifestyle change, as may the excessive use of near electronic devices.[24] Other proposed causes include light levels,[24] which may be directly related to time outdoors, with peripheral hyperopia in the myopic eye (corrected and uncorrected) encouraging axial growth,[25] and diet.[26] The global myopia in the year 2000 values in Figure 3, with the bulk of myopia in age groups younger than 40 years, reflects the significant lifestyle changes for children and young people over the past 10 to 25 years, especially in the large population centers of Asia.

Our projections, based on existing data, assume that these lifestyle changes will continue to spread with increasing urbanization and development. Accelerated changes, or reversal of recent trends, would be expected to increase or decrease future prevalence from our predictions, respectively. Our projections indicate that by 2050, 50% and 10% of the world will have myopia and high myopia, respectively, a 2-fold increase in myopia prevalence (from 22% in 2000) and a 5-fold increase in high myopia prevalence (from 2% in 2000). Higher amounts of myopia have the potential to cause vision impairment by myopic macular degeneration or its comorbidities, cataract, retinal detachment, and glaucoma,[27] the risk of which increase with any increase in myopia. Based on our projections and assuming the proportion of those with high myopia who go on to experience vision loss resulting from pathologic myopia remains the same, the number of people with vision loss resulting from high myopia would increase 7-fold from 2000 to 2050, and myopia would become a leading cause of permanent blindness worldwide. This is a conservative estimate; Figure 3 shows not only that will there be more people with myopia by 2050, but also that they will also be older and more susceptible to the pathologic effects of myopia than in 2000.

Our study design has some potential limitations. The first is the paucity of prevalence data in many countries and age groups, across representative geographic areas, racial groupings, and HDIs. This problem was greater for high myopia than myopia. The further the primary data are extrapolated, the greater the uncertainty of the estimates

becomes. Second, many countries and age groups across representative geographic areas, racial groupings, and HDIs lacked data on the change in myopia, especially high myopia, over time. Local effects on changes in myopia over time are potentially lost when annual changes are extrapolated across regions. However, Vitale et al[16] noted that the myopia and high myopia changes seen in African Americans were very similar to those in European Americans, suggesting that although environmental changes are important, racial differences probably are not. Third, projecting on the basis of current information has the potential to miss varying changes over time. Fourth, variations in the definition of myopia and high myopia in the evidence base made it necessary to adjust each prevalence we used to a standard definition, which increases uncertainty. There are conflicting data on the effect of gender on myopia prevalence. For example, Wu et al[28] found that girls in urban China were significantly more likely to have myopia than boys, whereas Hashemi et al[29] found the opposite to be true. With these sorts of conflicts, it seems unlikely that there is a simple gender effect on myopia development. There may be a more complex gender effect, where differential access to, encouragement to participate in, or choices with respect to education, outdoor activities, light exposure, or a combination thereof between boys and girls influences the development of myopia. We believed that this kind of gender effect was beyond the scope of this study, so we did not disaggregate based on gender. Also, we used a logarithmic decay function to estimate the future prevalence of myopia, and thus it is possible that future prevalence may have been overestimated, especially for regions where the current prevalences are moderate to low. However, given that there is an element of uncertainty associated with estimating future prevalences, regardless of the model or function used to derive estimates, drawbacks are likely to exist. More relevant is the clear evidence for a rising global prevalence of myopia, and thus these estimates simply indicate that if it continues on its present course, the future burden of myopia is likely to be substantial.

Because of the relatively common nature of myopia, even population studies with relatively small sample sizes can offer useful information provided the samples are representative. Other strengths include the large number of good-quality studies that have been performed in the regions that have both the highest prevalence of myopia and the largest populations (for example, East Asia, Asia-Pacific high income, and South Asia), our clear definitions and methods of standardizing source data, our analysis of the change in myopia over time, and our methods of calculating projected change.

We have not taken into account the effect of myopia control interventions that may take place between now and 2050. These would aim to reduce substantially the prevalence of high myopia. Interventions that sufficiently slow or delay myopia have the potential to prevent an individual developing high myopia, provided treatment is started early enough. Changes in lifestyle, successive improvement, and the uptake of myopia control could substantially reduce the number of people with myopia and high myopia. The uptake of myopia control, however, requires a strong evidence base and a concerted effort by government, education, and health systems.

In conclusion, our systematic review, meta-analysis, and projections provide myopia and high myopia predictions through 2050 and their distribution between GBD regions. Our estimates and projections assimilate local, individual studies into an improved global understanding of myopia epidemiologic factors. Our methodology provides a basis for validation of projections against new evidence as it is published. If correct, our projections have significant implications for planning comprehensive eye care services globally, which would need to cater to close to 1 billion people with high myopia by 2050, 7.5 times more than in 2000. The benefits of a multifaceted myopia control system to buffer this scenario would be substantial.

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Footnotes and Financial Disclosures

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Abbreviations and Acronyms:
D = diopter; **GBD** = Global Burden of Disease; **HDI** = Human Development Index.

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