A COMPARISON OF RISLEY AND BAR VERGENCES

SENIOR PROJECT

DAVID BECKER
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Introduction

Recently there has been interest in disparity and vergence mechanisms but measurement of them clinically has not kept pace. Right now the most popular way of measuring fusional vergence reserves is with the Risley prisms in a phoropter. However, recently Vaegan and Pye demonstrated the use of a motorized prism stereoscope to measure vergences at near but data from their study agree with reported values for break and recovery for both convergence and divergence measured with prisms in the phoropter.

This is fine but ideally it would be better to measure vergences in a more natural environment. The Beren's 15 prism bar allows this. A patient has peripheral cues and so is more aware of his surroundings and normal spatialization.

Another reason the prism bar is more natural is that a patient must make step vergence movements instead of a ramp type movement with a Risley prism. When a person looks from far to near, such as from the blackboard at school to his paper he is taking notes on, he makes a step vergence.

Probably the biggest advantage of the prism bar is its use in children. The break and recovery points can be viewed objectively by observing the eye-turn and fusional movements respectfully. The only problem with this is the difficulty in seeing small angle loss of fusion. In this case a subjective response is required.

There have been studies done which have found normals for near and far vergences with Risley prisms in a phoropter. What I want to

do in this study is compare Risley prism and bar prism vergences and also take into consideration eye dominancy.

Methods

A sample of 30 people were used in the study. There were 17 males and 13 females. Their ages ranged from 5 to 37.

I first found their dominant eye by having them make a circle with their thumb and first finger of each hand held at arms length. They were then instructed to put the circle around a small Snellen chart letter at the end of the room. Then I covered the patient's eyes one at a time to determine which eye was being used to fixate the circle around the letter. This was repeated several times until I felt confident I had determined their dominant eye. Next, I either did bar vergences or Risley vergences randomly so as not to contaminate the data by tiring out the patient with one before doing the other. I measured both base ins and base outs; break and recovery at near and far. In a study done by Michael D. Wesson, it was determined that it did not matter if base ins or base outs were presented first so I did not present them in any certain order.

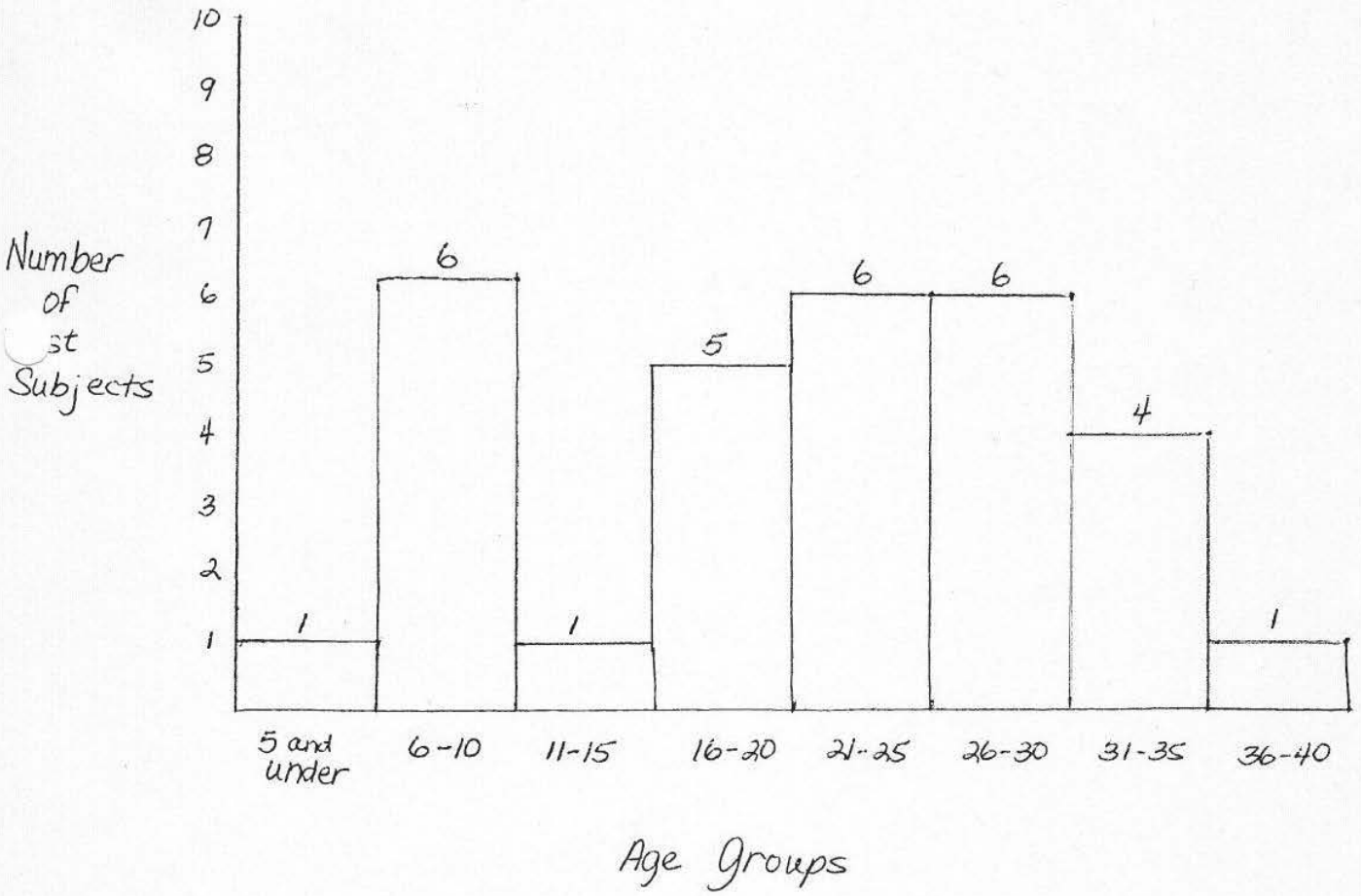
For a target, at distance I used a vertical column of Snellen letters of decreasing size from top to bottom. At near I used a yellow pencil with black print held vertically.

The patients were instructed to keep the letters single and report when they saw two and again when they saw one. Many times a blur response was given first but I did not record this because of the difference in blur detectors between patients. Therefore I was actually measuring the positive and negative fusional reserve instead

of the relative fusional vergence. I also recorded the age of each subject.

Data for the study is provided below.

Data



NAME	AGE	DOMINANT EYE	DOMINANT BI FAR	DOMINANT BO FAR	NON DOM BI FAR	NON DOM BO FAR	RISLEY BI FAR	RISLEY BO FAR	DOMINANT BI NEAR	DOMINANT BO NEAR	NON DOM BI NEAR	NON DOM BO NEAR	RISLEY BI NEAR	RISLEY BO NEAR
Crystal Larson	18	OD	12/10	10/8	12/10	16/14	12/6	22/6	18/14	18/16	14/10	16/14	24/20	36/30
Cliff Frazho	26	OS	8/6	20/18	6/4	30/10	8/6	26/20	12/10	16/14	16/14	20/18	22/20	20/12
Purvis Hunt	34	OS	4/2	25/16	4/2	14/12	7/4	32/28	6/4	25/20	8/6	10/8	8/4	36/18
Don Lorentz	23	OD	SUP OS	SUP OS	14/10	12/4	SUP OS	16/6	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	14/6
Dean Luplow	35	OS	10/8	8/6	8/6	6/4	10/9	19/14	16/14	>40	18/16	>40	16/14	>40
Paul Welker	19	OD	6/2	6/4	6/4	6/4	8/6	10/9	6/4	8/6	8/6	8/6	18/16	15/10
Bob Kennedy	24	OD	8/2	6/2	6/2	8/2	6/3	20/16	10/6	10/2	8/6	6/4	14/2	>40
Rick Scalcucci	30	OD	25/18	4/2	6/4	35/25	6/4	38/30	8/4	>40	4/2	>40	6/0	>40
Bob Kacembo	22	OS	8/6	>40	8/6	>40	10/8	>40	18/14	>40	18/14	>40	29/20	>40
Lynn Dosenberry	31	OS	6/4	8/6	8/4	16/4	13/9	16/10	12/10	35/25	14/10	25/18	26/18	>40
MP Chelsky	24	OD	6/4	14/6	8/4	18/10	6/4	30/11	10/8	35/25	12/6	40/35	7/0	41/30
Cheryl Baker	20	OD	10/8	30/6	10/8	40/14	10/8	30/26	18/12	25/20	12/8	35/25	22/18	>40
Pam Waite	26	OD	4/2	4/2	4/2	4/1	8/4	10/8	4/2	20/16	10/8	35/20	12/6	16/6
Ashley Luplow	35	OD	4/2	4/1	10/4	6/4	10/4	8/2	12/8	6/4	14/12	10/8	24/14	18/10
Mary Dexter	37	OS	6/4	6/4	6/4	4/2	8/6	20/18	21/10	16/14	10/8	20/16	22/12	28/20
Jim Archbold	12	OD	4/2	6/4	6/4	4/2	6/4	6/4	16/4	8/6	10/8	25/16	13/12	29/16
Tracy Mardis	23	OS	6/4	18/16	8/6	18/16	10/6	26/18	10/6	12/8	10/8	10/8	18/14	22/6
Lory Sygneski	21	OD	1/0	10/8	4/12	4/2	10/2	30/10	6/4	10/6	8/65	25/18	17/14	42/17
Wendy McCann	19	OS	4/2	12/8.	4/2	12/8	8/4	16/12	8/6	16/14	10/6	12/8	14/13	22/14
Andre Scalcucci	5	OS	4/2	6/4	8/1	8/2	6/1	12/10	2/1	6/4	4/2	6/4	18/9	34/14
Jennifer Hall	10	OD	4/2	14/8	6/2	8/2	8/3	24/9	8/4	12/4	6/2	8/4	20/10	36/20
Mike Brittner	10	OD	8/6	25/20	6/4	30/10	16/8	34/20	8/4	30/25	10/6	35/30	18/10	26/18
Ethan Allen	10	OD	6/4	4/2	4/2	4/2	8/6	24/6	4/2	6/4	4/2	6/4	18/14	32/18
Joan Scalcucci	26	OD	8/6	6/4	10/8	30/10	10/6	26/6	20/18	12/10	18/14	12/10	21/14	26/12
Kelly Spiess	20	OS	8/4	40/18	8/6	25/16	7/4	30/26	6/1	40/35	8/4	40/30	14/10	40/30
Jeff Goldner	8	OS	6/4	6/2	6/2	6/2	8/4	12/0	8/6	SUP OD	14/12	SUP OD	22/18	20/4
Mike Woodruff	10	OD	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS	SUP OS
Jim Summers	9	OD	4/2	10/6	6/1	10/4	6/2	8/-2	12/4	25/16	6/4	25/12	20/14	30/18
Dan Peterson	29	OD	12/10	>40	10/8	>40	11/6	>40	18/14	40/30	18/14	>40	32/24	>40
Jeff Wilson	28	OD	6/4	20/14	10/4	25/20	10/8	32/26	14/8	>40	12/10	40/35	38/10	38/32
		MEAN BR	6.32/	15.46/	7.31/	16.86/	8.79/	23.25/	11.12/	22.63/	10.86/	24.04/	19.04/	33.41/
		REC	4.07	11.24	4.34	7.63	5.18	12.93	7.29	14.26	7.93	15.26	12.5	16.41
		STD DEV BR	2.58/	12.16/	2.48/	12.78/	2.35/	10.51/	5.23/	13.69/	4.26/	14.08/	7.03/	10.45/
		REC	2.53	10.25	2.51	6.37	2.12	8.73	4.63	9.20	3.87	9.78	5.96	8.11

Results

Analysis of the data was accomplished by means of a statistical analysis computer program.

First, the mean and standard deviation was computated for each column. It should be noted that the means I found agree with previous means found in earlier studies, so we can therefore assume we have a normal population for this study.

Next, a paired t-test was run on 12 pair of columns; dominant to nondominant then each to Risley vergences, both done at distance and near. Because the recoveries were proportional in each catagory, only the breaks were used in the statistical computations.

From all the t-tests run on dominancy, only one showed that there might be a difference between presenting the bar prism before the dominant or nondominant eye. When bar BI vergences were compared at far between dominant and nondominant eyes, it showed that there was a 97% chance of there being a difference. However, when an annalysis of varience test (ANOVA) was run, there was a 15% chance of not being able to prove the hypothesis that there is a difference between dominant and nondominant BI to break at distance. My criteria is that there has to be at least a 95% chance of being able to prove the hypothesis. Both the t-test and the ANOVA showed that there is a 100% chance that bar vergences and Risley vergences are different and it can be proven 100% of the time.

There did not seem to be any significant difference between age groups as was also previously investigated by the Vaegan and Pye study.

Discussion

A prism bar provides many advantages over the Risley prism, the main being that the measurement of vergences suddenly becomes an objective test as well as a subjective test which comes in handy especially with non verbal patients or kids. It may also save time as I found out when I took my data. I had two people who supressed an eye but with the bar prism I could easily see that right away because the patient was making a version movement instead of a vergence movement. When a Risley vergence was measured, there was no way of telling this unless the patient voluntarily said the target was moving to one side or you run out of prism power with no break so actually you are just wasting time.

We found that it does not make any significant difference which eye the prism bar is placed in front of but there is definately a difference between bar prism vergences and Risley vergences with Risley's being higher because it is a ramp type vergence instead of a step vergence like a bar prism is. We use a step vergence most often when we look from distance to near so the prism bar is a more natural way of assessing a patients vergence ability.

BIBLIOGRAPHY

Vaegan, Pye D., "Independence of Convergence and Divergence: Norms, Age trends, and Potentiation in Mechanized Prism Vergence Tests; Am J Optom Physol Opt, vol 56 (1979) pp 143-152.

Wesson, Michael D., "Normalization of Prism Bar Vergences", Am J Optom Physol Opt, vol 59:8 (1982), pp 628-634.