CASUAL FIXATION DISPARITY TESTING: COMPARING THE SALADIN CARD TO THE SHEEDY DISPAROMETER

by

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ABSTRACT

Background: The purpose of this study was to determine if the Saladin Card and Sheedy Disparometer would result in comparable FD measurements under casual testing parameters as normally used in a clinical setting. *Methods:* 32 young adults age 19 to 38, with best corrected near visual acuity in place resulting in 20/20 vision were tested to measure fixation disparity with the Saladin Card and the Sheedy Disparometer through prism loads of 0, 4BI and 4BO. *Results:* The Pearson r correlation coefficient comparing the Saladin Card and the Disparometer show a statistically significant correlation with r=.50 for 0, r=.68 for 4BI and r=.45 for 4BO. Also evident with this study is a large amount of variability in the Disparometer readings and the trend toward smaller magnitude readings with the Saladin Card. *Conclusion:* Under casual testing conditions, the FD measurements done by the two instruments are correlated and likely related. The results though can be contaminated by the large amount of variability in Disparometer readings. Though the two testing methods correlate well, the smaller magnitude of the FD results from the Saladin Card can make using the same norms questionable.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction:

Fixation disparity (FD) is a slight misalignment of the visual axes (measured in minutes of arc) while still maintaining single binocular vision. Exact corresponding retinal points are not stimulated but fusion still occurs due to the images falling within Panum's fusional area. FD measurements can indicate stress on the fusional vergence system, can be associated with heterophoria and asthenopia, and can aid in prescribing prism. The near fixation disparity can be measured with a number of devices, such as, Sheedy Disparometer, Bernell unit, Mallet unit, Wesson Card, and Saladin Near Point Balance Card (Saladin Card). The Sheedy Disparometer is the instrument most commonly used to measure FD in clinical situations, but is considered to be more time consuming than the Saladin Card [1]. The Saladin Card can be used to measure both associated and dissociated phorias, is clinically more efficient, and generally yields more repeatable measurement than the disparometer [2].

The purpose of this study was to determine if the Saladin Card and Sheedy Disparometer would result in comparable FD measurements under casual testing parameters as normally used in a clinical setting.

Methods:

Horizontal FD readings were taken from 32 young adults, ranging in age from 19 to 38, with best corrected near visual acuity in place resulting in 20/20 vision. A Modified Thorington was given (at 40 centimeters) in straight-ahead position and reading gaze to rule out any A/V pattern. The subject was then randomly presented with a Saladin Card or Sheedy Disparometer. The subject held each device at 40 centimeters in

straight-ahead gaze and wore polarized lenses to view the vernier polarized nonius lines. The subject was advised to keep the words surrounding the polarized circles clear. A penlight was held behind the Saladin card to illuminate each circle until the subject identified the one that contained perfectly aligned vertical nonius lines. A penlight was used to illuminate the target on the Disparometer as the subject adjusted the dial to achieve perfect alignment of the vertical nonius lines. FD results were recorded from both devices as measured through forced vergence demands of 0, 4BI and 4BO prism diopters.

Results:

Pearson correlation coefficients, r, were calculated for FD measurements comparing the Saladin Card and the Disparometer through 0, 4BI and 4BO prism diopters. All were deemed to show a statistically significant correlation with r=.50 for 0 prism, r=.68 for 4BI and r=.45 for 4BO. Figures 1-3 show scatter plots that include the trend line for each. A Pearson r was also calculated for the phoria between straight ahead gaze and reading gaze to rule out any A or V patterns that could possibly affect the data if not held strictly straight ahead. The Pearson r=.94 which is statistically significant correlation, indicating the phorias in different gazes are very likely to be closely related.

	Disparometer			Saladin Card		
	4BI	ortho	4BO	4BI	Ortho	4BO
Average	2.8	-2.3	-4.3	0.2	-1.7	-2.7
Standard Deviation	4.8	7.5	7.1	2.8	3.3	3.1

Table 1

Table 1 shows the average and standard deviation at each prism demand for each instrument. Negative values for this paper will indicate exo FD and positive values will

indicate eso FD. The standard deviation is greater for all of the Disparometer readings as compared to the Saladin Card readings. This indicates that there is more variability in the Disparometer readings as compared to the Saladin Card.

	Exophores (n=23)			Esophores (n=6)		
	Phoria	Disp	SC	Phoria	Disp	SC
Average	-3.7	-3.9	-2.3	2.0	1.3	-0.2
Standard Deviation	2.5	8.1	3.7	1.3	4.1	1.0
Pearson r		0.44			0.66	

Table 2 Disp = Disparometer SC = Saladin Card

Table 2 shows the average, standard deviation and Pearson r for the FD through no prism of the 23 exophores and 6 esophores. In Table 3, the 3 orthophores were combined with each the exophores and the esophores and the average, standard deviation and Pearson r was calculated for FD through no prism.

	Exophores(n=23) + Orthophores(n=3)			Esophores(n=6) + Orthophores(n=3)		
	Phoria	Disp	SC	Phoria	Disp	SC
Average	-3.3	-3.2	-2.1	1.3	1.8	-0.2
Standard Deviation	2.6	7.9	3.5	1.4	3.4	1.1
Pearson r		0.47			0.53	

Table 3 Disp = Disparometer SC = Saladin Card

As is shown in Table 1,2 and 3, the Saladin Card tends to give readings that are closer to zero as compared to the Disparometer.

Discussion:

This study was done to compare the FD measurements by the Saladin card and the Disparometer under casual testing conditions where just one measurement is taken under only a few different prism loads. This study found that under casual testing conditions, with prism load of 0, 4BI and 4BO, the two tests correlated well. Some things to consider with this study is the variability found in the Disparometer, the lack of

esophores represented in the sample and the trend toward smaller in magnitude readings with the Saladin Card.

The results appear to be more variable for the Disparometer versus the Saladin Card. This was also found to be the case by Zurakowski et al.[3], who found that the Disparometer was more variable and less repeatable than the Saladin Card. Even though the two measuring methods correlated well, the variability in the Disparometer could have lead to a skewing of the data. This point can be further supported by my associate, Patricia Hoogeveen's research, which compared FD measurements for the Saladin Card with and without the central distracters. This research only using the Saladin Card found much less of a problem with variability. Though this study was not done to investigate the variability of either test, it indicates that multiple readings must be used and averaged when using the Disparometer to reduce some of the variability in the results.

Another variable in this study seems to be the under representation of esophores or over representation of exophores. Out of 32 test subjects only 6 were found to be esophores. Though when looking through the data, more individuals with no prism in place gave eso FD with the Disparometer (15 subjects) than with the Saladin Card (5 subjects) even though the average FD for the Disparometer was more exo at –2.3 than the Saladin Card at –1.7. In the Frantz et al.[2] study, they found that the Disparometer frequently gave eso FD with no prism and the Saladin Card most often exo FD. This was supported by the average FD measurement that they found with no prism in place (Disparmeter = 2.1, Saladin Card –1.4). The difference between the two studies again could be due to the large variability in the Disparometer readings or the lack of esophore representation in this study.

The data also shows that the Saladin Card tends to give smaller in magnitude results than the Disparometer. This trend shows up in the average at each prism load. This is also supported by studies done by the Frantz et al.[2] study which stated that "the Saladin Card generally gave smaller FD measurements (as compared to the Disparometer)"[2] and Zurakowski et al.[3] study, which stated that "the amount of fixation disparity at any given vergence demand determined with the SNPC (Saladin Card) tended to be conservative when compared to that determined with the Disparmeter."[3] In a study by Ngan et al.[4], comparing FD measurements taken by the Saladin Card to those with the Wesson Card, they found that the Saladin Card found results that were smaller than those of the Wesson Card. One hypothesized explanation is that the Saladin Card's strong fusion lock causes readings to be smaller than those of the Disparometer and the Wesson Card[2,4]. This then poses the question of what is the which instrument gives the real FD, the Disparometer, Wesson Card or Saladin Card?

Conclusion:

This study showed that under casual testing conditions, the FD measurements done by the Saladin Card and Disparometer are correlated and likely related. As has been found though, the results can be contaminated by the large amount of variability in Disparometer readings, suggesting that when dealing with the Disparometer, multiple readings should be taken. Though the two testing methods correlate well, the smaller magnitude of the FD results from the Saladin Card can make using the same norms questionable. Further testing would be needed to determine if the same clinical norms that have applied to the Disparometer, apply to the Saladin Card.

REFERENCES

1. Corbett A and Maples WC. Test-retest reliability of the Saladin Card. *Optometry* 2004;75:629-39.
2. Frantz K, Elston P, Michalik E, Templeman C. Comparison of Fixation Disparity Measurements Obtained with Saladin Near Point Balance Card and the Sheedy Disparometer. Illinois College of Optometry.
3. Zurakowski T, Keszo N, Saladin J. Repeatability of fixation disparity measurements: a comparison of the Saladin Near Point Card and the Sheedy Disparometer. *Optom Vis Sci* 2003;80(Suppl):37.
4. Comparison of Fixation Disparity Curve Parameters Obtained with the Wesson and Saladin Fixation Disparity Cards. *Optom Vis Sci* 2005;82:69-74.

Figure 1: Ortho Comparison

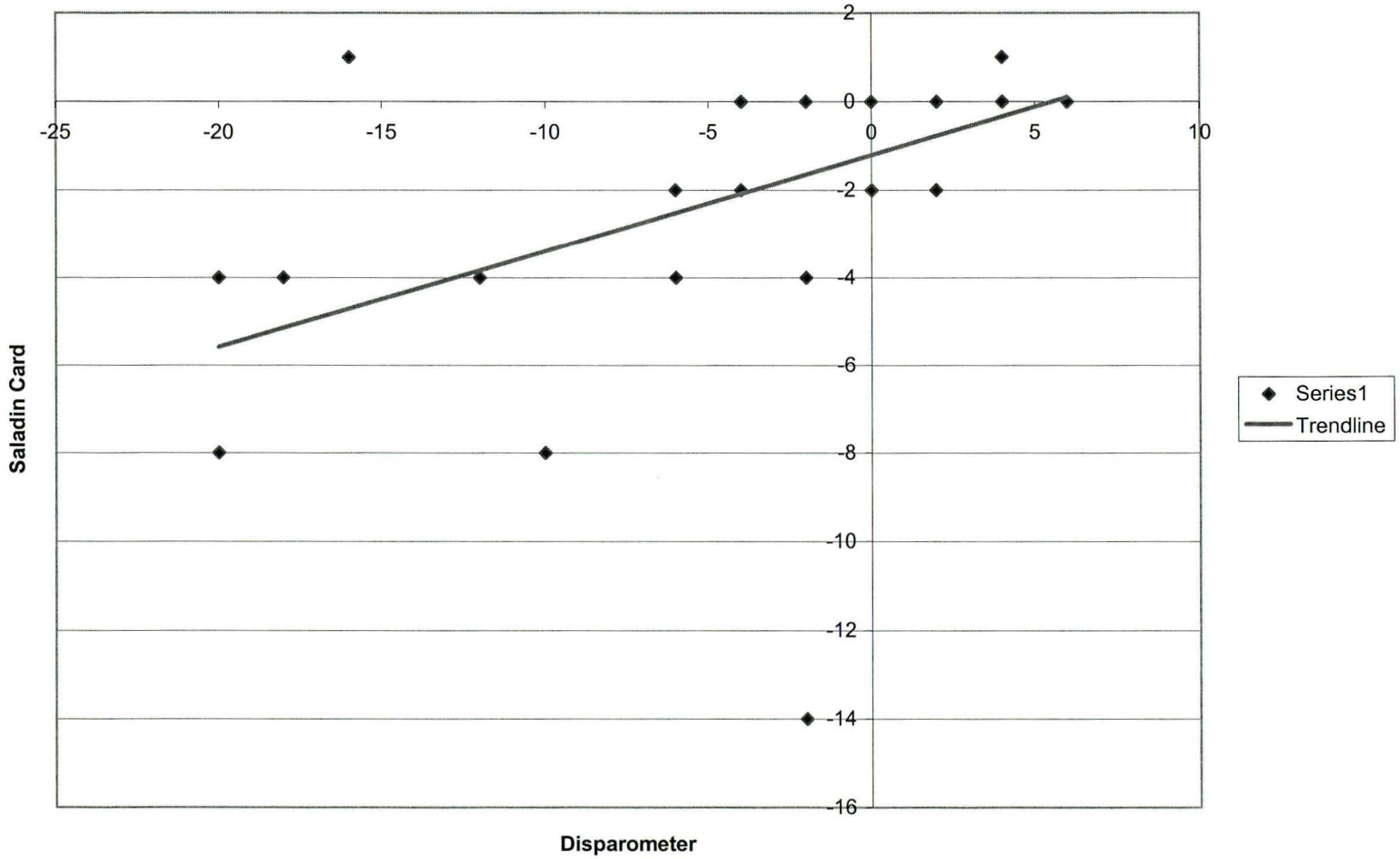

Figure 2: 4 BI Comparison

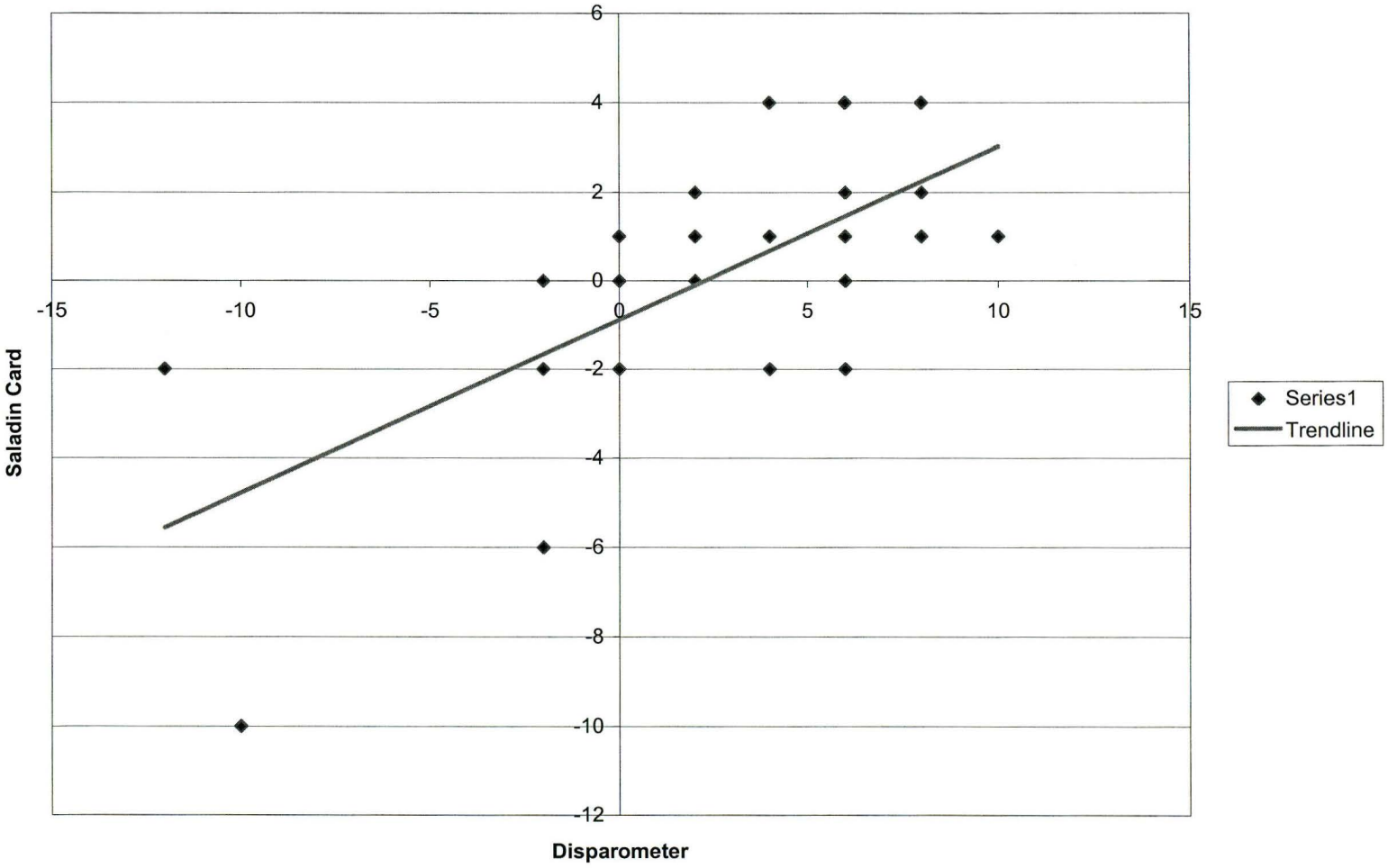

Figure 3: 4 BO Comparison