DIRECT COMPARISON OF BINOCULAR NEAR VISUAL ACUITY MEASURED USING THE BAILEY-LOVIE NEAR VISUAL ACUITY CARD AND THE SALADIN NEAR POINT BALANCE CARD

by

Nathan P. Forst

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ABSTRACT

A controlled clinical study was performed to determine whether a significant difference existed between binocular near visual acuity levels measured using the Bailey-Lovie Near Visual Acuity Card and the Saladin Near Point Balance Card. Binocular near visual acuities were measured for 100 patients over the age of ten. Acuity was measured using the total number of equivalent letters read per card, starting with the largest print size row and then each subsequent row, until the patient missed three sequential letters. Total letters read per patient were statistically analyzed using a paired T-test. No significant difference was found between binocular near visual acuity levels measured using the Bailey-Lovie Near Visual Acuity Card and the Saladin Near Point Balance Card ($t(99) = -0.18$, $P > .05$). In fact, a strong positive correlation was found between the binocular visual acuity levels measured using both cards ($r = .85$). It appears that using the Saladin Near Point Balance Card as a clinical tool for the measurement of binocular near visual acuities is as efficacious as using the Bailey-Lovie Near Visual Acuity Card.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Numerous methods exist for the measurement of near visual acuity. A widely established tool for the measurement of near visual acuity is the Bailey-Lovie Near Visual Acuity Card. The principles behind the design of the Bailey-Lovie Near Visual Acuity Card control for all other variables, allowing size of the optotype to be the only changing variable between acuity levels. This standardization is first accomplished by utilizing a logarithmic size progression, so that size ratio is consistent from one level to the next. Secondly, the same number of letters in each row are required per size level. Thirdly, the spaces between letters and between rows must be proportional to letter size. Finally, the optotypes used at each level must have equivalent legibility.[1]

To further understand the principles of the Bailey-Lovie design, one must look at the research and support of each design factor. First, the logarithmic scaling of letter size on visual acuity charts is widely accepted and has been found to be more appropriate than other designs.[2,3] Secondly, the use of 5 letters per acuity level is a design feature that allows for efficiency of the task and reliability of the data collected. It has been shown that the reliability of visual acuity measured has been found to increase with increased number of letters at near-threshold levels.[4,5,6] However, little statistical advantage is gained and the efficiency of the clinical test decreases when using more than 5 letters. Thirdly, the spacing between letters and between rows is made proportional so that no variation in spacing exists between acuity levels.[1] Finally, research supports that the Sloan and British letter families, each consisting of 10 letters which show little variation in legibility, are now widely used on visual acuity charts.[2,7,8]

The Saladin Near Point Balance Card also contains a near visual acuity chart that employs most of the Bailey-Lovie design principles. The primary difference between the acuity charts on the Saladin card and the Bailey-Lovie card is the vertical spacing of the letter rows within each chart. The spacing between rows on the Bailey-Lovie card are proportional to the letter size of each acuity level, whereas the spacing between rows on the Saladin card are consistently 4 mm. Investigations of the Saladin Near Point Balance Card have already established the usefulness of the card for testing fixation disparity and its test-retest reliability.[9,10] However, no investigation of the card's efficacy for measuring near visual acuity has been performed. To determine the efficacy of the Saladin Near Point Balance card for measuring near visual acuity, a direct comparison was made with the Bailey-Lovie Near Visual Acuity Card.

METHODS

Measurement of binocular near visual acuity was performed on 100 patients over the age of ten using the Saladin Near Point Balance Card and the Bailey-Lovie Near Visual Acuity Card. Acuity was measured using the total number of equivalent letters read per card, starting with the largest print size row and then each subsequent row, until the patient missed three sequential letters. Because the near visual acuity chart on the Saladin card contained only 40 letters, only the equivalent letters on the Bailey-Lovie card were used during the testing. Total letters read per patient were statistically analyzed using a paired T-test.

RESULTS

The binocular near visual acuities of 100 patients, consisting of 41 males and 59 females, were measured using both near point cards (Table 1). The age range of the patients in the study was 10 to 81 years of age, with a mean age of 37. No significant difference was found between binocular near visual acuity levels measured by equivalent letters read per patient, using the Bailey-Lovie Near Visual Acuity Card (Mean = 36.39, SD = 17.31) and the Saladin Near Point Balance Card (Mean = 36.35, SD = 10.88), t (99) = -0.18, P >.05. In fact, a strong positive correlation exists between binocular near visual acuity levels measured using either card (r = .85) (Figure 1).

DISCUSSION

The results of this study strongly suggest that using the Saladin Near Point Balance Card as a clinical tool for the measurement of binocular near visual acuities is as efficacious as using the Bailey-Lovie Near Visual Acuity Card. It appears that the variation in the vertical spacing of the letter rows within each chart has little effect on the mean number of equivalent letters read per patient.

However, anecdotal observations noted during this study suggest possible design weaknesses inherent in each card. Patients seemed to have trouble reading the 20/20 line on the Saladin Near Point Balance Card due to print quality of the letters. Primarily, the H and the N in the 20/20 line were most often confused and missed by patients. On the other hand, some patients appeared to more easily read letters correctly in the 20/25 and 20/20 rows on the Saladin card, whereas on the Bailey-Lovie Near Visual Acuity Card, crowding of the letters on the 20/25 and 20/20 rows made letter recognition difficult. The

crowding phenomenon appeared to be related to the proportional vertical spacing between letter rows, which was the primary design difference from the Saladin Near Point Balance Card.

Although these slight anecdotal differences were noted during the study, no significant difference in patient performance was noted between the cards. It would appear, based on this study, that the Saladin Near Point Balance Card and the Bailey-Lovie Visual Acuity Card are equivalent clinical tools for measuring binocular near visual acuity. This suggests that the Saladin Near Point Balance Card can also be used to reliably determine binocular near visual acuity levels of patients in the clinical setting. Therefore, binocular near visual acuity testing is another clinically proven characteristic of the versatile Saladin Near Point Balance Card.

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Table 1: Equivalent Letters Read per Patient using the Saladin Near Point Balance Card and the Bailey-Lovie Near Visual Acuity Card

Patient	Age	Gender	Saladin	Bailey-Lovie
1	28	Female	37	38
2	28	Male	39	38
3	52	Female	27	30
4	24	Female	37	38
5	36	Female	38	40
6	16	Female	34	32
7	44	Female	29	28
8	72	Female	36	34
9	57	Female	29	25
10	15	Male	37	39
11	43	Male	36	34
12	81	Male	26	25
13	64	Female	29	25
14	12	Female	39	40
15	10	Male	35	26
16	45	Female	38	40
17	24	Male	38	39
18	41	Male	37	40
19	41	Male	37	39
20	57	Female	35	36
21	70	Female	33	35
22	34	Female	36	37
23	48	Female	32	30
24	71	Male	32	30
25	16	Female	38	40
26	12	Female	38	37
27	28	Female	39	40
28	20	Male	38	40
29	11	Male	37	40
30	21	Male	37	40
31	65	Female	34	30
32	21	Female	37	36
33	32	Male	39	40
34	14	Male	38	40
35	13	Male	38	39
36	30	Female	40	35
37	18	Male	38	40
38	44	Female	30	30
39	46	Male	38	36
40	31	Female	40	40
41	19	Male	37	39
42	19	Female	38	39
43	43	Female	35	30
44	12	Female	34	34
45	62	Male	36	40
46	55	Female	37	38
47	16	Female	38	39
48	15	Female	37	37

49	58	Male	38	39
50	55	Male	33	34
51	52	Female	34	35
52	45	Female	25	30
53	12	Female	37	39
54	18	Male	38	39
55	32	Female	36	37
56	23	Male	39	40
57	45	Female	32	33
58	54	Female	36	37
59	27	Female	37	35
60	41	Male	36	36
61	14	Male	40	40
62	53	Female	32	36
63	63	Female	34	33
64	23	Male	38	39
65	31	Female	39	37
66	47	Female	37	35
67	17	Male	39	40
68	65	Female	33	29
69	22	Male	39	40
70	15	Female	40	40
71	36	Female	38	40
72	61	Male	38	35
73	24	Female	38	39
74	47	Female	36	37
75	33	Male	39	38
76	13	Female	40	40
77	26	Male	39	38
78	57	Male	35	33
79	43	Female	38	38
80	37	Female	38	39
81	74	Female	29	25
82	21	Female	40	40
83	21	Male	39	38
84	42	Female	38	37
85	53	Male	37	38
86	25	Male	40	40
87	34	Female	39	38
88	67	Female	33	35
89	61	Male	38	37
90	15	Male	40	40
91	59	Female	37	35
92	43	Female	38	38
93	23	Male	40	38
94	31	Female	38	40
95	16	Male	40	40
96	78	Female	30	27
97	37	Male	38	40
98	46	Female	37	39
99	54	Female	37	37
100	36	Male	39	40

Figure 1. Scatter-Plot Comparing Letters Read per Patient using the Saladin Near Point Balance Card and the Bailey-Lovie Near Visual Acuity Card