Warning On Inaccurate Rosenbaum Cards for Testing Near Vision

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Abstract. The Rosenbaum card is the most widely used handheld card for measuring near visual acuity. It was developed by Dr. J. George Rosenbaum of Cleveland, Ohio, for testing vision at the bedside of patients after cataract surgery. Millions of copies of the Rosenbaum card have been distributed free by drug companies or sold by medical supply firms. Most versions of the Rosenbaum card are inaccurate because the numbers are not scaled properly to the Snellen system. This article reviews the history of the Rosenbaum card, briefly summarizes issues raised by near vision testing, and provides standards for the manufacture of Rosenbaum near cards. (Surv Ophthalmol 42:169-174, 1997. © 1997 by Elsevier Science Inc. All rights reserved.)

Key words. Jaeger • Snellen • near vision • Rosenbaum card • visual acuity

The handheld Rosenbaum card is often employed to measure visual acuity when a standard Snellen system, for testing at 20 feet, is not convenient or available. It is also the method used most widely in medicine for the assessment of near vision. Recently, we saw an elderly woman who developed difficulty seeing in her right eye after resection of a frontal meningioma. At the bedside an acuity of J10 (20/100 distance equivalent) was recorded (by M.R.J.) in the right eye with a Rosenbaum card with best refractive correction for near. Upon re-examination an hour later, an acuity of J5 (20/50 distance equivalent) was found (by J.C.H.). This discrepancy in acuity measurements led to some disagreement and confusion until we examined our Rosenbaum cards more closely.

The first acuity measurement of 20/100 was obtained with a near card distributed by Allergan Pharmaceuticals, Irvine, CA (Fig. 1). To our surprise, inspection of the numbers on the 20/25 and 20/30 lines showed they were nearly identical in size. The same was true of the numbers on the 20/40 and 20/50 lines. Next, we compared the Allergan card with the second Rosenbaum card, which had produced the better acuity reading of 20/50 (Fig. 2). Checking the numbers on each card, line by line, their correspondence in size was poor. At this point the reason for our differing acuity measurements became obvious: the numbers on the 20/70 line of the Allergan card were actually smaller than the 20/50 numbers on the other card.

After discovering optotypes of different size on these two cards, we sought to determine the correct size of numbers on each line of a Rosenbaum card. A search of the medical literature provided no answer. The specifications for a Rosenbaum near card have never been published. To learn more, we contacted Dr. J. George Rosenbaum (Fig. 3) and discov-
ered interesting information about Dr. Rosenbaum and the evolution of his card.

**History of the Rosenbaum Card**

Dr. Rosenbaum was born on May 3, 1909, in New York City. After graduation from Rush Medical College in 1936, he did residency training in pulmonary medicine and opened a general medical practice. At the outbreak of World War II, he joined the United States Army and served as a physician with the Air Transport Command. Upon discharge he returned to general medicine from 1946 to 1956. He then decided to take a residency in ophthalmology, which he completed in 1959 at Bronx Municipal Hospital, affiliated with the Albert Einstein College of Medicine. He practiced general ophthalmology for 30 years and retired in 1990. He currently lives near Cleveland.

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**Fig. 1.** This card for testing near vision (distributed by Allergan Pharmaceuticals) borrows from the layout and wording of the Rosenbaum card, but alters the numbers used on each line, except 20/100. The sequence of symbols used to test illiterate patients is identical, revealing its direct connection to Rosenbaum's card. The numbers are not scaled accurately to Snellen dimensions. Note also that the numbers on the 20/25 and 20/30 lines are nearly equal in height, as are the numbers on the 20/40 and 20/50 lines.

**Fig. 2.** Rosenbaum card sold by Prestige Medical, Northridge, CA, for $.95 as a “Pocket Eye Chart”. Rosenbaum’s name has been deleted from the top, but the chart is otherwise identical to the original Rosenbaum Pocket Vision Screener. The height of the numbers on most lines differs from the Allergan card. Only the 20/200 line is printed accurately to reduced Snellen proportions. Numbers on the 20/20 line are poorly printed and barely readable.
Ohio. The following is Dr. Rosenbaum's account of the development of his famous card.

In the early 1960s, Dr. Rosenbaum designed the first pocket-sized vision screener, for testing his patients at the bedside after cataract surgery. It was a miniature, scale version of a Snellen chart on a 3x6 inch card. He approached numerous drug companies, suggesting that they distribute his card as a gift item to doctors to promote sales. There was little interest. After several years, the Smith, Miller & Patch Company, renowned for a baldness tonic called "Herpicide," finally accepted his proposal. A trial run of 10,000 cards was printed and offered to conferees at the 1963 American Academy of Ophthalmology and Otolaryngology meeting. The entire supply was consumed within a week. The Rosenbaum card rapidly gained popularity. In 1974 the millionth Rosenbaum card was printed by Smith, Miller, and Patch. The company is now defunct, but the cards continue to be given away as a promotion by other drug companies and sold by medical supply firms. Today, an estimated five million cards have been distributed, and they can be seen tucked in the breast pocket of nearly every medical student's white coat.

**Evaluating the Discrepancies**

The Rosenbaum card is based upon the Snellen system for measuring acuity, although it uses numbers not letters. In the Snellen system, the letters on the 20/20 line have a height of 8.73 mm and are viewed at a distance of 6 meters. These parameters correspond to a visual angle of 5' (minutes) of arc, or $1/12$ of a degree (arctan 8.73/6000). Ideal letters, such as "E," are comprised of lines with a thickness of 1' and fit within a 5'x5' grid (Fig. 4). In principle, to identify the test letter, the observer must have the ability to resolve elements subtending only 1' of arc. In practice, letters can often be guessed from their overall configuration, without actually resolving 1' of arc, and some letters are easier to guess than others. In the late nineteenth century, the matter of which letters to include on a Snellen eye chart was debated at international meetings of ophthalmological societies. Letters containing curved segments created the biggest dilemma, because they did not fit easily into the blocklike format conceived by Snellen. Eventually the elaborate block letters conceived by Snellen fell into disuse, in favor of more simplified fonts. However, the big "E" still commands the 20/400 line, as a relic of the original Snellen chart.

We scaled a Snellen chart to the Rosenbaum viewing distance of 14 inches (355.6 mm) and calculated the appropriate height of the characters on each line (Table 1). Next we scanned the Allergan card into a computer at a resolution of 600 dots per inch, magnified the numbers on each line so that they could be measured easily on the monitor, and determined the height, using Mocha software (Jandel Sci-
TABLE 1

Comparison of Various Near Vision Measuring Systems

<table>
<thead>
<tr>
<th>Visual Acuity</th>
<th>Ideal Reduced Snellen Chart</th>
<th>Allergan Card</th>
<th>Prestige Medical Card</th>
<th>Original Rosenbaum Card</th>
<th>Lebensohn Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/800</td>
<td>20.71</td>
<td>19.92</td>
<td>21.02</td>
<td>20.38</td>
<td>20.99</td>
</tr>
<tr>
<td>20/400</td>
<td>10.35</td>
<td>10.03</td>
<td>10.62</td>
<td>10.42</td>
<td>10.44</td>
</tr>
<tr>
<td>20/200</td>
<td>5.17</td>
<td>4.87</td>
<td>5.17</td>
<td>5.36</td>
<td>5.26</td>
</tr>
<tr>
<td>20/100</td>
<td>2.59</td>
<td>2.46</td>
<td>3.56</td>
<td>3.79</td>
<td>2.59</td>
</tr>
<tr>
<td>20/70</td>
<td>1.81</td>
<td>1.67</td>
<td>2.54</td>
<td>2.93</td>
<td>1.77*</td>
</tr>
<tr>
<td>20/50</td>
<td>1.29</td>
<td>1.32</td>
<td>2.03</td>
<td>2.08</td>
<td>1.27</td>
</tr>
<tr>
<td>20/40</td>
<td>1.03</td>
<td>1.23</td>
<td>1.48</td>
<td>1.50</td>
<td>1.03</td>
</tr>
<tr>
<td>20/30</td>
<td>0.78</td>
<td>0.76</td>
<td>1.24</td>
<td>1.33</td>
<td>0.83</td>
</tr>
<tr>
<td>20/25</td>
<td>0.65</td>
<td>0.75</td>
<td>1.03</td>
<td>1.02</td>
<td>0.62</td>
</tr>
<tr>
<td>20/20</td>
<td>0.52</td>
<td>0.68</td>
<td>0.76</td>
<td>0.71</td>
<td>0.48</td>
</tr>
</tbody>
</table>

*The Lebensohn Chart does not have a 20/70 line, but a 20/65 line instead.

Scientific, Inc., San Rafael, CA). Table 1 compares the heights of numbers on the Allergan card with the ideal heights derived from Snellen proportions. As one can see, some of the lines are depicted accurately (e.g., 20/30, 20/50), whereas others are off by a fraction of a line or by an entire line (e.g., 20/20 is actually 20/25, 20/25 is actually 20/30). We also measured the heights of numbers on our other Rosenbaum card, sold by Prestige Medical of Northridge, CA. It did not fare well either in comparison with the Snellen card scaled to 14 inches. The numbers on every line, except 20/200, were too large. For example, the numbers on the 20/25 line were actually equivalent to 20/40 near Snellen acuity.

At this point, we became curious about the heights of numbers on each line of a genuine Rosenbaum card. Dr. Rosenbaum kindly provided a card, one of the last original specimens in his possession (Fig. 5). Compared with ideal Snellen dimensions, the numbers were too large, except on the 20/800 and 20/400 line. For example, the numbers on the 20/100 line were about 45% too large. Added to the magnification provided by aphakic spectacles, this card would have rendered an overly optimistic post-operative assessment of near acuity in cataract patients 30 years ago. The original Rosenbaum card does have the virtue of preserving a strict 5X5 element grid for the 20/200, 20/400, and 20/800 lines. This format is relaxed in the Prestige Medical card in favor of more rounded letters and is abandoned completely in the Allergan card.

For the 20/20–20/100 lines all the cards use a font similar to Times New Roman. This font was selected by the British Faculty of Ophthalmologists in 1951. It did not conform to the Snellen concept of using 5X5 elements to construct a letter or number, but had the virtue of being easily available to all printers so that a standard font could be used for near vision testing by all ophthalmologists.

On Rosenbaum cards the numbers on each line are also defined in terms of point size. A point is 1/72 of an inch. However, this does not mean that a number on the 3 point (20/20) line of a Rosenbaum near card is 3/72 inches tall. The point designation refers to the distance from the top of a capital letter (e.g., "P") to the bottom of a descender (e.g., "p"). To complicate matters further, the point system refers not to the height of the typeface itself, but to the typeblock, which includes the typeface plus a shoulder to separate printed lines. None of the standard point sizes (3, 4, 5, 6, 8, 10, 14, and 26) available in Times New Roman is exactly the right height needed for the corresponding reduced Snellen line. Therefore, in the past it has been impossible for printers to make accurate near cards for vision testing using a regulation Times New Roman font. Indeed, much of the imprecision in near vision testing has stemmed from the technical constraint imposed by having to print reduced Snellen characters with standard, defined point sizes. Fortunately, the use of metal types for printing is fast becoming obsolete. The advent of newer printing methods should permit the exact scaling of Times New Roman to the correct reduced Snellen dimensions (Table 1). We have experimented with a computer-generated near card printed at 600 dots per inch resolution from a laser jet printer and achieved sharp, legible numbers 0.52 mm tall on the 20/20 line.

It is worth mentioning Jaeger's system for testing near vision.1 Introduced in 1854, it has fallen into disuse because the Jaeger typesetter's fonts are no longer available commercially. The Jaeger system also had the shortcoming of going down only to a size equivalent to approximately Snellen 20/25 and
20/30. For this reason, the 20/20 line on a Rosenbaum card has no counterpart in the Jaeger system, and hence is referred to as "J1." Although the Jaeger system is no longer employed by most examiners, many continued to write down near vision using the Jaeger notation (e.g., J1, J2, etc.) to connote the fact that near vision is being recorded. However, one should be aware that the original Jaeger font correlates only roughly with the Snellen equivalent for any given line.

We have measured the height of numbers on each line of a wide sample of Rosenbaum cards that are sold or distributed gratis by various companies. There is marked variation in the height of numbers from card to card. All the cards tend to print the numbers too large, especially those on the smallest lines. In some cases, we suspect the letters are printed too large to compensate for poor quality reprographics. For example, the numbers on the 20/20 line of the Rosenbaum card sold by Prestige Medical are so fuzzy that they are barely legible (Fig. 2), despite being printed 50% larger than they should be. A card with clearly printed numbers on the 20/20 line measuring only 0.52 mm tall would be more expensive to manufacture, and therefore, less attractive to companies seeking an inexpensive advertising item for free distribution.

It should be pointed out that near vision testing is an imprecise art at best. Presbyopes seldom hold the card exactly at 14 inches—not should they. It is more important that the card be held where it is seen in best focus. The examiner can then note the actual testing distance along with the near acuity.* The use of strong plus or minus corrective lenses alters the effective size of the card’s image upon the retina. Lighting conditions vary widely from one testing situation to another. Finally, the spacing between numbers on each line of a Rosenbaum card is not proportional to their size. Dr. Rosenbaum was aware of these limitations, which is why he considered his card merely a pocket vision screener, not a faithful reduced Snellen chart.

The problems of testing vision at near are made worse by the fact that most Rosenbaum cards are incorrectly scaled, and the errors on each brand of card vary from one manufacturer to another. The mistakes are usually minor, but can lead to conflicting reports of visual acuity, as occurred with our patient recovering from neurosurgery. The heights of numbers we have provided in Table 1, based upon an ideal Snellen chart scaled to a viewing distance of 14 inches, should be used as the standard for Rosenbaum cards. Rosenbaum cards manufactured according to these specifications will require more careful production by printing firms. They will also require physicians to refract presbyopes more carefully to attain 20/20 acuity at near. This prospect will not be welcomed by refractionists in a hurry.

HOW was near vision tested before the advent of the Rosenbaum card? The most popular method used a near vision test chart designed by Dr. James E. Lebensohn of Northwestern University Medical School. The chart, copyrighted in 1935, featured a miniature Snellen chart laminated onto a block of

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*Fig. 5. An original card, provided by Dr. J. George Rosenbaum, preserves the blocklike font advocated by Snellen for the top three lines, and converts to a Times Roman style for the remaining lines. The card is quite faithful to Snellen proportions for the top three lines, but the rest of the numbers are too tall. The columns on the right side provide calibration to point size, Jaeger’s system, and Snellen distance equivalents.
1/2 inch plywood measuring 4 X 8 1/4 inches. We measured the height of numbers on the original Lebensohn chart (Table 1). It is remarkably faithful to Snellen’s standard, with only the 20/800 lines deviating more than 0.1 mm from ideal dimensions. The Lebensohn chart is still available, but expensive (approximately $50-$60) and bulky, accounting for its lack of popularity. Nonetheless, it is more accurate than any version of the Rosenbaum card in circulation. It should be possible for manufacturers to produce inexpensive, convenient, pocket-sized Rosenbaum cards with the accuracy of the old Lebensohn charts.

Dr. Rosenbaum did not copyright his card, nor did he ever make a penny from it.1 He is quite willing to allow anyone to reproduce his card without payment of a royalty. Indeed, by tradition, the Rosenbaum card has been distributed free by drug companies. Dr. Rosenbaum asks only that the words Rosenbaum Pocket Vision Screener be left at the top of his card. This seems like a reasonable request, and most, but not all, companies have honored it. We hope future distributors of the card will continue to honor Dr. Rosenbaum for his ingenious and selfless contribution to ophthalmology by leaving his name at the top of the card.

References

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