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Near point card for reduced visual acuity patients

Abstract
BACKGROUND A near point card was developed for the testing of patients with reduced visual acuity at near. The unique feature of the card is the ability to isolate a single horizontal and vertical demand line based on the patient’s minimal near point acuity. This is to allow for easier testing of vergence and accommodation ranges.

METHODS Eighty-one cards were distributed to Pacific University College of Optometry’s Class of 1998 for use during fourth year clinic. Seven months post-distribution a survey was conducted to determine the card’s efficacy.

RESULTS Half of the survey respondents found the card useful for patients with decreased visual acuity. An additional 26% used the card for even broader clinical situations. Frequency of use was evenly spread from "not at all” to "5 or more times” per month. The design of the card was rated as good by a majority of surveys.

DISCUSSION Most respondents liked and used the near point card. Suggestions for future improvements were made should the card become more widely marketed.

Degree Type
Thesis

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NEAR POINT CARD FOR REDUCED VISUAL ACUITY PATIENTS

BY

DEREK ALLMER

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
For the degree of
Doctor of Optometry
May, 1998

Advisor: Suzanne Scott, O.D.
NEAR POINT CARD FOR REDUCED VISUAL ACUITY PATIENTS

AUTHOR:

Derek M Allmer

FACULTY ADVISOR:

Suzanne Scott, O.D.
BIOGRAPHY

The author, Derek Allmer, attended North Dakota State University for four years before receiving his Bachelor of Science Degree in Visual Science from Pacific University, Forest Grove, Oregon. After four years of optometric studies, the Doctor of Optometry Degree is to be bestowed upon the author on May 17, 1998 by Pacific University College of Optometry. During his tenure at Pacific University, Derek served as President, Treasurer, Equipment Representative and Fourth Year Representative of the Class of 1998. He also served a one year term on the Student Government. Activities included Amigos Eye Care, American Optometric Student Association, Beta Sigma Kappa Optometric Honor Society, and Phi Theta Upsilon social fraternity. Mr. Allmer participated in two global eye care missions, one in Taiwan and the other in Brazil. Derek’s externship experiences were at Hickam Air Force Base, Hawaii and Hot Springs, SD VA Medical Center. Upon graduation, Mr. Allmer's plans include starting his professional career by securing a position in a private practice in Minnesota or Arizona.
I would like to thank the following people for their contribution to this thesis:

- Suzanne Scott, O.D., for guidance and grammar skills
- Gwyn at Alphagraphics for getting the printing process off the ground
- The Class of 1998 for using and testing the near point card
- Beta Sigma Kappa for their generous financial support
- Lan Tran, for her donated time and support

Derek Allmer
ABSTRACT

BACKGROUND
A near point card was developed for the testing of patients with reduced visual acuity at near. The unique feature of the card is the ability to isolate a single horizontal and vertical demand line based on the patient’s minimal near point acuity. This is to allow for easier testing of vergence and accommodation ranges.

METHODS
Eighty-one cards were distributed to Pacific University College of Optometry’s Class of 1998 for use during fourth year clinic. Seven months post-distribution a survey was conducted to determine the card’s efficacy.

RESULTS
Half of the survey respondents found the card useful for patients with decreased visual acuity. An additional 26% used the card for even broader clinical situations. Frequency of use was evenly spread from “not at all” to “5 or more times” per month. The design of the card was rated as good by a majority of surveys.

DISCUSSION
Most respondents liked and used the near point card. Suggestions for future improvements were made should the card become more widely marketed.
INTRODUCTION

Many optometric students and doctors of optometry use a near point card with a single 20/20 visual acuity demand line for testing of near point phorias, vergence amplitudes, and accommodative amplitudes. The card contains a horizontal 20/20 line on one side and a vertical 20/20 line on the other. The horizontal line is commonly used for vertical phorias, prism base up and base down duction ranges, and relative accommodation ranges, while the vertical line is often used for lateral phorias and prism base in and base out vergence ranges.

This standard near point card functions well for the majority of patients. However, there is a select group of people for whom this card is not viable because of the small letter size. Patients with reduced visual acuity (defined here as best corrected visual acuity which is less than 20/20) cannot see the 20/20 lines clearly, causing them to give a less exact response to the optometrists' tests.

When faced with a patient with reduced visual acuity, practitioners previously had four choices. The first option was to avoid the hassle of gathering difficult data by not performing the testing. This is not a viable alternative since important information may be overlooked. A second choice was to proceed with testing using the standard near point card. Since accommodative testing relies on the perception of blur as an endpoint, the patient's inability to see the line clearly will make accurate testing impossible. A third option available to practitioners was using an entire reduced Snellen chart, with acuity lines from 20/20 to 20/200 displayed, as a target. This is not a reasonable alternative since the larger letters provide an imprecise accommodative target, therefore overestimating accommodative amplitudes. It is imperative that only the line of minimum resolution be displayed for accurate testing.

The best method previously available for near point testing of patients with reduced visual acuity was isolation of a single horizontal demand line on a reduced Snellen chart. This provides a clear target with a good accommodative lock. However, isolation is accomplished by overlaying a piece of paper with a cut-out rectangle on the desired line. Lining everything up correctly can be awkward and may portray an unprofessional image to the patient. Also, the horizontal line is not ideal for testing of lateral phorias. For this a vertical line provides a more accurate target.

This project set out to develop an adjustable near point card that individually displays acuity lines of varying demand, from 20/25 to 20/200. Both a horizontal and vertical line of the same acuity demand will appear on opposite sides of the chart at the same time. This card will allow for quick and efficient near point testing of patients with reduced visual acuity.
METHODS

A near point card consisting of acuity lines of 20/25, 20/30, 20/40, 20/50, 20/60, 20/80, 20/100, 20/150, and 20/200 at forty centimeters was designed in MS Word. It was determined that Arial font had the most Snellen-like characters and was used throughout the design process. A 10X peak scope was used to measure actual printed letter size to match font point size with acuity demand (see Table 1). This allowed for height estimations to be made to the nearest hundredth of a millimeter for increased accuracy.

Table 1

<table>
<thead>
<tr>
<th>Acuity Demand</th>
<th>Calculated Size (mm)</th>
<th>Arial Font Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/25</td>
<td>.729</td>
<td>2.5</td>
</tr>
<tr>
<td>20/30</td>
<td>.874</td>
<td>3.5</td>
</tr>
<tr>
<td>20/40</td>
<td>1.17</td>
<td>4.5</td>
</tr>
<tr>
<td>20/50</td>
<td>1.46</td>
<td>5.5</td>
</tr>
<tr>
<td>20/60</td>
<td>1.75</td>
<td>7.0</td>
</tr>
<tr>
<td>20/80</td>
<td>2.33</td>
<td>9.0</td>
</tr>
<tr>
<td>20/100</td>
<td>2.92</td>
<td>11.0</td>
</tr>
<tr>
<td>20/150</td>
<td>4.37</td>
<td>17.0</td>
</tr>
<tr>
<td>20/200</td>
<td>5.83</td>
<td>23.0</td>
</tr>
</tbody>
</table>

For the design of the card, a sliding chart inside a jacket was decided upon. One horizontal and one aligned vertical window on the opposite side of the jacket would allow for two lines of the same acuity demand to be displayed at once. A chart template was created by aligning a horizontal and vertical line of each acuity demand on opposite sides of a sheet of paper.

One hundred cards were printed by Alphagraphics of Beaverton, Oregon on a low-gloss heavy weight tagboard paper. Horizontal and vertical windows were cut in the same material and then 100 jackets were glued together. The chart slid in between the jacket.

The cards were distributed to the 81 members of Pacific University College of Optometry Class of 1998 in April, 1997 for use during their fourth year clinic and preceptorship rotations. Seven months after distribution, a survey (see Appendix A) was distributed to assess the card's usefulness and design.
RESULTS

Of the 81 distributed, 54 surveys were completed and returned, equaling a response rate of 67%. The following tables and frequency histograms illustrate the distribution of responses.

Question 1: “How clinically useful was the card?”

<table>
<thead>
<tr>
<th>Reply</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never encountered a situation appropriate for use of the card</td>
<td>15</td>
</tr>
<tr>
<td>In rare situations</td>
<td>9</td>
</tr>
<tr>
<td>Good for use with decreased VA patients</td>
<td>50</td>
</tr>
<tr>
<td>Useful in several clinical situations</td>
<td>26</td>
</tr>
</tbody>
</table>

![Frequency Histogram](image)
Question 2: “On average, how many times per month have you used the card?”

<table>
<thead>
<tr>
<th>Reply</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>30</td>
</tr>
<tr>
<td>1-2</td>
<td>22</td>
</tr>
<tr>
<td>3-4</td>
<td>26</td>
</tr>
<tr>
<td>5 or more</td>
<td>22</td>
</tr>
</tbody>
</table>
Question 3: “How would you rate the design of the card?”

<table>
<thead>
<tr>
<th>Reply</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>0</td>
</tr>
<tr>
<td>Fair</td>
<td>17</td>
</tr>
<tr>
<td>Good</td>
<td>61</td>
</tr>
<tr>
<td>Excellent</td>
<td>22</td>
</tr>
</tbody>
</table>

Comments were also gathered on the survey questions (see Appendix B). Twelve respondents noted the card was useful with decreased VA patients. Other uses suggested by single clinicians were as a near point testing card for all patients, for children who have memorized the Snellen chart, as a typoscope, and for accommodative facility testing.

Comments on how many times the card was used included two who used it often for geriatric patients and one who used it more at Pacific University clinic. Four surveys indicated that a multiple display rotary chart supplied by preceptors was used instead. There was much feedback on the design of the card. The majority of respondents felt the card had a good design. However, some flaws in the design were noted. These included the chart being hard to slide inside its jacket noted by eight surveys. Also, the need for a more professional looking cut-out of the isolation window was mentioned by six respondents. Five surveys felt a rotary chart design would be a faster method to change acuity lines. Four respondents indicated a desire to include a 20/20 demand line so the chart could be used as a near point testing card for all patients. Two surveys suggested accomplishing this by dropping the larger 20/200 optotype in favor of a 20/20 line. The reasoning for dropping the 20/200 line was infrequent near point testing of
patients with such reduced near acuity. Three clinicians would like to have seen the same letters used for corresponding horizontal and vertical lines, which are displayed simultaneously front and back. This would have allowed for easier verification of what the patient was reading by following along on the back of the card. Two surveys favored a more durable design while another two indicated a larger jacket would line up with the patients' eyes in the phoropter better. Poor printing quality was noted by two surveys.

**DISCUSSION**

The goal of this study was to determine the efficacy of a new near point card designed for reduced visual acuity patients. The unique feature of this card is the ability to isolate a single horizontal and vertical demand line based on the patient's minimal near point acuity, thus providing more accurate vergence and accommodative testing results. Most of the survey responses indicated the card was good for use with decreased visual acuity patients. Other uses for the card that clinicians implemented were as an all-purpose near point testing card and for flipper facility testing. The concept behind the card's unique feature seemed to be well accepted.

Based on the survey results, an improved design would incorporate many modifications. A roto-chart wheel design would make switching acuity lines easier. Spinning instead of pulling the card would result in smoother transitions between acuity demands. A more phoropter friendly design would be developed for better alignment with the patients' eyes. The same letters would be used for the vertical and horizontal line of an acuity demand for easier verification of the patients' replies. Another improvement would include dropping the 20/150 and 20/200 demand lines in favor of a 20/20 line. This would increase applicability to all patients and eliminate rarely used demand lines. With a larger production scale, printing quality and the isolation box cut-out are areas that would acquire a more professional look. These are all valid areas that could use improvement and contribute to the increased quality of the near point card.

Several surveys mentioned using a commercially available roto-chart for near point testing. There are several varieties available, but most include various acuity charts, a grid for accommodation testing, and near cylinder tests. At most there is one vertical and one horizontal isolated acuity line for vergence testing and one other isolated line for accommodative amplitude testing. The unique feature of the near point card that is the topic of this thesis is the ability to isolate a vertical and horizontal line based on the patients' minimum near point acuity. None of the commercially available rotary charts offer this function.

It is important to know that using different acuity demands for vergence and accommodative testing may affect the expected findings. Jones and Kulas state that "PRA and NRA endpoints significantly differ when various acuity demands are used for testing." Normative data is offered in the paper. This is something to keep in mind when using a larger demand line for near point testing.
Works Cited

Appendix A

HELLO CLASSMATES OF 1998!!

At the end of April, 1997, each of you received a near point card for reduced visual acuity patients. This card has been the focus of my thesis project, which is now entering its final stage. In order to gather some data on the card, I am asking each of you to complete the short survey below, whether you used the card or not. A self-addressed stamped envelope has been included for your convenience in returning the survey. Thank you for your help in my thesis project!

Derek

Near Point Card for Reduced Visual Acuity Patients

1. How clinically useful was the card?
   - Never encountered a situation appropriate for use of the card
   - In rare situations
   - Good for use with decreased visual acuity patients
   - Useful in several clinical situations
   Comments: __________________________________________

2. On average, how many times per month have you used the card?
   - None
   - 1-2
   - 3-4
   - 5 or more
   Comments: __________________________________________

3. How would you rate the design of the card?
   - Poor
   - Fair
   - Good
   - Excellent
   Comments: __________________________________________

Any suggestions for improvement of the card? ________________________________________

Thank you for participating in my thesis project. For your efforts, you get my appreciation : )
Appendix B

SOME COMMENTS GARNERED ON THE USEFULNESS OF THE NEAR POINT CARD:
-I used it most of the time to do almost all close up work while at Southeast clinic
-My patients have rarely been 20/20 patients and having a vertical 20/30 has been great for phorias and vergences at near
-Good with elderly patients or lower acuity patients; also good because I can isolate lines to lessen confusion on which line the patient should read. I’ve also used it in V.T. with kids who already have the Snellen card memorized
-very useful with difficult patients; good with elderly patients
-Only used the card once, but works well with decreased Visual Acuity patients. Also good for phorias of different demands
-Very helpful, nice to have an option
-I did not carry it with me regularly so I was not able to try it out
-I used it quite a bit at the VA, but not much during my clinic rotation
-I only used the card a few times. I favored my cards with the grid target and other targets together
-Good for geriatric, amblyopic, or low vision patients. Did not use for patients with best visual acuities <20/50, here usually concerned about decreased acuity rather than getting exact answers on other testing
-Used for amblyopes and anisometropes as well as to find Rx for computer use: if patient said font “about this size”
-I loved the idea of this card. It makes phorias and vergences possible in decreased acuity patients
-great idea, not everyone sees 20/20 at near even with correction.
-Used it a lot at Pacific University College of Optometry, have not used it here at preceptorship
-used in facility testing, +/- 2.00 flippers
-I used it as a typoscope for children, to isolate a line
-also good for amblyopes who need line acuity; also good when patients don’t get the idea to read smallest line etc.; good for phorias with low vision patients
-I haven’t dealt with too many low vision, amblyopes with whom I spent a large amount of time dealing with. However, at the Pacific University clinic, we have more time to work with patients, and have more patients for which we use this card. I found it very helpful with the few amblyopes/nystagmus/low vision patients I dealt with
-I forgot I had it. I wish I would’ve remembered. I saw lots of low vision patients.
-Worked well for those who could not see 20/20 line at near.
-I am unsure of the usefulness although good idea. A low vision or decreased vision patient will not have the battery of near point tests run on them. Therefore, is it practical?
-It did come in very handy for phorias for low vision patients

COMMENTS ON HOW MANY TIMES PER MONTH THE CARD WAS USED:
-During summer at VA I used it quite a bit
-Preceptors preferred that I used the cards/equipment provided
- Good idea... I used the card with many geriatric patients and foreign patients with decreased best visual acuity
- Used it at Pacific University clinic, none on preceptorship
- Had a card similar to your card at my clinic site
- Should have used it more in hind-sight
- Near card with various targets was supplied on preceptorship, although may have used it more if I needed my own card
- Works great
- In the interest of time, I often just used the near point card recommended and attached to the reading rod by my preceptor (another multiple display card)
- I use a similar card provided in clinic that has a wheel and opening. There are many different near point cards combined into one on the front and back
- I use it more than my Snellen card now

COMMENTS ON THE DESIGN OF THE CARD:
- In different clinics, I have encountered cards similar to your card but with more VA lines in different acuities
- Mine is kind of beat up now. If it were laminated or made of plastic like the rotochart cards they may last longer.
- Sometimes difficult to slide the card back and forth, hard to get it started. More of a notch on the edges to grab and slide easier. Possibly larger, so that the patient's eyes are looking straight at the letters out of the phoropter.
- I prefer a wheel design better (faster)
- Only difference I'd suggest is "factory" made since the patient gets such a close view of it, but obviously that's not something you could help for your thesis
- Have tags on the ends to easily pull out the card
- Tab to move target needs to be easier to move and adjust; use same letters on backside of card
- Maybe more compact would be better
- It would be nice if the letters were standard, i.e. FZBDE4, etc. so that I did not have to look at the card to see if the patient was calling them out correctly, or if 20/40 vertical letters matched 20/40 horizontal letters I could just watch the back of the card to see if the patient was correct
- I love it just this way
- Would be easier to use if it were on a rotary spin wheel
- Patients with 20/20 acuity at near had a hard time seeing the 20/25 letters, patient was bothered by the letters that hung out the side
- It was awkward pulling the card to expose the various demands. I would make it a little longer than the holder to make it easier to work with
- Better cut-out of the center window (I know it was difficult, but it would appear more professional); incorporate a grid target
- Needs to be cut out straight; larger notch so that it's easier to push out the other side; patient does not want to see something that looks homemade; include 20/20 demand line on the card so that the clinician only has to have one card for all patients—could drop some of the larger letters
- Make some adjustments for easier sliding while on the near rod
- Hard to get a grip and pull the inner card out at the end. I'm personally fond of the rotator cards
- It works pretty slick, makes it easier for old folks
- Great design
- The cards are printed crappy and even 20/20 people can't see the letters; rotating card of plastic may be better
- Same letters on both sides so Doc could know what patient reads without looking from other side
- Only disadvantage was having another card to deal with. I like the idea of most frequently used tests on one card. Maybe integrate it with other tests onto a wheel type card
- Better if it had a 20/20 line so you could use the card for everyone rather than having to switch cards for someone who can't see 20/20; the patients I used it with often asked which line I wanted them to look at if there were other lines sticking out the side
- Sharper cuts on edges of window for letters; better balanced
- I like it
- Needs to be longer vertically so it can be clipped onto rod of phoropter and still be seen by patient
- Nice printing quality; finer, more precise incisions/cuts; large tab/inset cut
- Very well thought out. I loved the design
- The window of my card is slightly misplaced. So, the letters cannot be seen in their entirety
- Easy to use