Smith-Kettlewell Reading Test (SK Read)

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- Funding to develop this test was provided in part by the Smith-Kettlewell Eye Research Institute and the Pacific Vision Foundation
- The concept of this test comes from valuable clinical experience that the authors have had with the MN Read test of Gordon Legge et al and the Pepper Visual Skills for Reading Test of Gale Watson et al.

Rationale for the SK Read Test

- The SK Read Test was developed to assess the reading performance of English speaking adults who may be encountering central or paracentral scotomas (visual field defects)
- The majority of patients referred for low vision rehabilitation have central visual field disruption (Reference: Fletcher, D.C.; Schuchard, R.A.: Preferred Retinal Loci (PRLs) Relationship to Macular Scotomas in a Low Vision Population, Ophthalmology, Vol. 104, Number 4, April 1997)
- Because of perceptual completion patients are frequently unaware of the presence of central scotomas, yet they affect reading performance profoundly (Reference: Fletcher, D.C.; Schuchard, R.A.; Watson, G: Relative Locations of Macular Scotomas near the PRL: Effect on Low Vision Reading; Journal of Rehabilitation Research and Development, Vol. 36, Number 4, October 1999, pp 356-364)
- The format of the MN Read Test allows it to be performed rapidly and easily. It focuses attention on impairments of resolution and is useful for determining the impact of print size on reading performance. It can be used to establish the critical print size – the smallest font where maximal rate of reading can be accomplished and is useful for estimating the response to magnification. It uses simple words in complete sentences and this tends to mask the visual field problems. When a patient has a scotoma interfere with the identification of a word, rather than verbalize an incorrect thought, they often reassess the break in context until it makes sense and then verbalize the correct wording.
- The Pepper Visual Skills for Reading Test utilizes non contextual words and is useful for identifying scotoma related mistakes. However, its format does not allow for as rapid testing with various text sizes as the MN Read format.
- The SK Read Test is designed to allow words to be easily confused and facilitate the verbalization of mistakes encountered while reading. The pattern of verbalized mistakes can help to differentiate left and right sided scotoma interference.

Characteristics of the SK Read Test

- Blocks of text range in size from 8 M units (8 times larger than 1 M newsprint) down to 0.4 M units (less than half the size of 1 M newsprint)
- Each block contains 47 letters or 60 characters including spaces. (The MN Read also has 60 characters, including spaces, per text size block)
- Each block of text contains 6 single letters, 1 two letter word, 2 three letter words, 3 four letter words, 3 five letter words, and 1 six letter word. Words were chosen from the 1000 most commonly used words in the English language.
- The use of single letters facilitates misidentification of two letter words as a single letter.
- Words that could stand alone with a letter missing from the beginning or end of the word were specifically included.
- No meaning is present in the text.
- Text is in high contrast black print on a white background.

Potential Uses of the SK Read Test

- In low vision rehabilitation clinical practice, the test can be used to identify scotomas that are interfering with reading. It is useful as a training tool to demonstrate to patients where they have a pattern of errors. It can be used pre and post training to monitor improvement in patient performance. Like the MN Read it can be used to determine critical print size and magnification requirements. The test can be used with standard reading glasses or alternately can be performed with low vision enhancement equipment.
- The test has potential application in clinical practice in general ophthalmology and particularly retinal practices. It is a useful measure of macular function that is to a significant degree independent of visual acuity. (see ARVO 2006 Nair, Fletcher, et al; SK Read Shows More Errors Than Continuous Text) Single letter visual acuity indicates the health of a very small area of the macula. This test reflects the function of a much larger area of the macula.
- The test can be utilized in research regarding any disease process that can affect the central visual field pre and post treatment as well as for rehabilitation research.

Testing Materials

- SK Read Charts – version 1 and version 2 are equivalent and can be used for test retest purposes.
- Stop watch – for timing interval required to read each block of text.
- Score Sheets – have every block of text present on the test, providing space for noting mistakes to be noted and time to read each block.

Test Administration

- Patient should be comfortable and whatever they feel is optimal lighting is permitted. This may vary from patient to patient.
- The test is to be performed with the patient's standard reading correction. (unless the test is being used to evaluate performance with a specific vision enhancement device)
- Test administration distance should be noted but the patient should be allowed to use what they feel is the optimal distance. When retesting is performed, the setting should be identical to allow before and after comparison.
- Patient is instructed to read aloud the test material. They are advised that the text has no meaning and they should read every word that they encounter. When they encounter a single letter they should say the letter. Instruct the patient that if the word has two or more letters they should say the word and not spell it.

- Patient is instructed that this is a timed reading test and they are to perform it as rapidly as possible. They should read as far down the chart as is possible and guessing is encouraged.
- Record the time required to read each block/size of text on the score sheet. Start the stopwatch as soon as the patient starts to view the text. Do not wait until they verbalize the first word. It may be necessary to stop the patient after each block so that there is time to record the time and the mistakes in each block. If this is done, it is easiest to "mask" the blocks below the one being read so that the patient automatically stops after the block being read.
- Note every mistake the patient makes on the score sheet. When a word is omitted, cross it out on the score sheet. When incorrect words are substituted, cross out the word/words and write above them what the substitution is. If a mistake is made and then corrected, record the misidentification and then write /c beside it to indicate the correction. Several misidentifications of the same word offered sequentially are only counted as one mistake.
- If the patient asks about the correctness of a word, give an ambiguous answer such as "You are doing fine, we will discuss the words after the test is over".
- It is counterproductive to rehabilitation efforts to frustrate the patient or emphasize the negative. Be positive and encouraging as the test progresses. In discussion of the test indicate to the patient that identification of error patterns is the first step in learning compensations that will later minimize them.

Scoring the Test

- Score the number of seconds required to read each block of text to the nearest tenth of a second. In addition to the time for each block, an average per block can be calculated by totaling the rates for all blocks read and divided by the number of blocks read.
- All misidentifications and omissions are counted as errors. Even corrected mistakes are recorded as errors. The total number of mistakes can be divided by the number of blocks to give the reading error rate per 60 character block.
- Do not include the final block of text read in the calculation of reading rate and error rate. Slowed reading and mistakes are anticipated at the limits of resolution and are not as likely to reflect macular pathology/loss of function.
- Mistakes that drop the first letters of words or misidentify the first few letters of words are classified as "left sided" mistakes. Mistakes that drop the last letters of words or misidentify the end of words are classified as "right sided" mistakes.

Interpretation of Test Results

- When it is not possible to read 1M print there is obviously a need for magnification.
- The M unit size of the last print block that can be read at near maximum rate is a good indicator of the X power magnifier that will be required to reach peak reading rate. (e.g. If 4 M print was the last size read rapidly, then a 4X magnifier will be required to reach that level of performance with 1 M print. The 4X magnification will give 1 M print the same size retina image as 4 M unmagnified.)
- Rapid accurate reading of the SK Read to the limits of resolution often indicates no encumbering scotomas. If these patients have reduced acuity and cannot resolve 1 M print they may simply need magnification. They can often resume reading with no specific visual skill training as long as they can use magnifiers well and have adequate contrast.
- In an educated person who was previously a good reader of the English language:
  - The more frequent the reading errors, the more likely scotomas are to be present in the central visual field – likely within 2 degrees of fixation. Or,
  - If all sizes of text are read slowly and mistakes are frequent, then it is likely that there is significant scotoma interference with reading. (Simply giving this patient magnification will result in slow, inaccurate, frustrating reading. The primary problem is not magnification.)
- A pattern of primarily right sided errors is a good indicator of scotoma(s) to the right of fixation. Mistakes (especially omissions) that occur more toward the beginning/left of the lines of text can also indicate right sided scotoma interference.
- A pattern of primarily left sided errors is a good indicator of scotomas to the left of fixation. Mistakes (especially omissions) that occur more toward the end/right side of the lines of text can also indicate left sided scotoma interference.
- An error pattern with left and right sided mistakes can be caused by scotomas on both the left and right sides of fixation.
- Frequent errors with no clear pattern is often indicative of the presence of scotomas with a poor quality preferred retinal locus (PRL/fixation area).
- Reading large font sizes slowly with mistakes, speeding up for moderate size fonts and then slowing down for small size fonts is an indicator of ring scotomas. Ring scotomas will cause both left and right sided reading errors.
- These correlations have been demonstrated by a study using the scanning laser ophthalmoscope (SLO) to confirm the location of scotomas. (see ARVO 2007 Fletcher, Schuchard, and Watson; Low Vision Reading Performance Comparison of MN Read and SK Read Considering Errors and SLO Determined Scotomas/PRL Characteristics)
- The greater the number of errors per block on the SK Read the greater the need for visual skill training for the patient to improve reading performance.
- The error pattern on the SK Read can be a valuable teaching tool to raise the patient's awareness of scotoma interference. The patients will often be oblivious to their mistakes until the clinician points them out.
- Errors on the SK Read may also indicate a reader having more problem with numbers and highly technical reading material.

SK READ SCORE SHEET

Name
Date — Age
Eye Tested — OD OS OU — Test Distance
Magnification Used? — Yes No
Average Seconds per Block
Average Mistakes per Block
Mistake Pattern
Education Level — 1st Language
Hours Spent Reading/Week (pre morbid)
Comments

8.0 M

as c yes gold d edge
ball swing r monkey
theme y water h run g

6.3

t vans p open keeps
afraid noted e hi eye
x sob a skill k meat

5.0

o coats also j care z
den lobs scared job
q seven c those v is

4.0

do saved z box o sit
b grow nods p close
owner i dear t raises

3.2

r mad t harm moves h
so laws soil a stone
paint s filled and n

2.5

hey m own j dots we
near c night q smash
u sand trust e waiter

2.0 M

s rat girl z branch g
mark v tons at x fit
donor pages p wheel

1.6

t or q got fill d nose
i any m wired uses
leads ready spoils y

1.3

he m b shops p nap
r zip fair rugs s late
bring u think closer

1.0

bet bone y rows pan
people that e black x
n heard v snows k in

0.8

q gap s z son i taxes
adds n hour allow a
of heart slower what

0.6

x o hen p one here go
party m seat ways g
faces swear r window

0.5M

h mop b pad o down
they to brace t image
q start throws k flow

0.4

h solved u jaw x it d
mud show pits meets
stand c woman r join

SK READ SCORE SHEET

Name
Date | Age
Eye Tested | OD OS OU | Test Distance
Magnification Used? | Yes No
Average Seconds per Block
Average Mistakes per Block
Mistake Pattern
Education Level | 1st Language
Hours Spent Reading/Week (pre morbid)
Comments

8.0 M

to e ink band d earn
hash flute t pickle
floss c heart s tan j

6.3

f pine k sink heart
window sight c up say
s top p think g rant

5.0

k clear wage f pair x
ten loss sliced fit
h bland c exact v if

4.0

so flash c box m sit
s know tops p flash
teach g fear d basket

3.2

f sad n free charm r
do flaw sold b clone
pulls s danger fan n

2.5

joy m old v note me
tear b light n stack
s land trees e walker

2.0 M

b fat sang d landed g
fins w kite or p hot
stark makes r stage

1.6

i to q not mill d hose
t map m tired fuse
plead chain steady y

1.3

in m b chops p tap
z rip kiss hugs s mate
chair u stack closes

1.0

let bike r fill fan
throws know s shack z
n hears v smart c of

0.8

s lap g o ton t files
aids a sour flour k
he start blooms plow

0.6

o r pen s son gear to
stars h neat clay y
trace warts a murmur

0.5M

k pop p dad i this
pour it clown h round
c front female b trim

0.4

h helper s saw c to v
mad slow bits meals
bland m trust f fill