THE EFFECTS OF VARIOUS FILTERS ON CONTRAST SENSITIVITY AND VISUAL ACUITY

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ABSTRACT

Currently, many low vision and normal vision patients subjectively enjoy better vision with certain filters. This study was set up to assess the difference in various filters; to see if specific colors and transmissions help to increase visual acuity and/or contrast sensitivity function in low and medium lighting situations. Twenty subjects were evaluated to study these effects. Ten filters were utilized, six from N.O.I.R., three from the C.P.F. series by Corning and an Opticlear antireflective coating. This study has helped to identify that there is a definite preference of certain filters which increase contrast as well as visual acuity.

KEY WORDS

Filters, contrast sensitivity, visual acuity, light transmission

INTRODUCTION

Many patients have become acutely aware of the importance of ultraviolet/infrared protective sunwear, via increased media exposure of the subject. It follows, that optometric advice shall become more frequently sought regarding the effects of commonly prescribed ophthalmic filters, on patient comfort, contrast sensitivity and visual acuity, under specified lighting conditions. Much literature exists pertaining to the effects of such filters on pathological patient populations but we have found little information relating the effects of filters on non-pathological subjects.

Initially, the goal of our study was to determine the effects of various filters on contrast sensitivity and visual acuity for pathological and non-pathological eyes. However, we were unable to recruit any subjects with eye pathology to participate in this experiment. Therefore, our study attempts to disclose the effects of the Corning 511, 527, 550, the NOIR amber (54% total light transmission - tlt, 18% tlt, 8% tlt), NOIR gray-green (58% tlt, 16% tlt, 1% tlt) and the Opticlear Antireflective coating on contrast sensitivity and visual acuity, for a non-pathological group of participants.

The filters to be used were selected, based on their frequency of use in the Optometric Institute and Clinic of Detroit's low vision facility.

METHODS

An experimental study was conducted on twenty subjects from the Ferris State College of Optometry student body. The subjects ranges in age from 22 to 33 years of age and none had a history or signs of any ocular pathology. Twelve of the subjects had 20/15 Snellen acuity, eight had 20/20 acuity. Five of the participants were spectacle corrected (provided the lenses had no tints or coatings), eight were contact lens corrected (lenses were also untinted) and seven subjects required no correction.

Ten filters from three different manufacturers were tested in our study. The filters are listed in Table 1 below. Each lens was measured in a light transmission tester, to determine the exact total light transmission percentage. Seven of the filters were 60 mm blank lenses and three were manufactured in the form of a fit-over goggle. All of the filters were plano in power.

Following Snellen measurement of patient acuity in the eye being used for testing, the subject was monocularly occluded and seated 1 meter from the Pelli-Robson Contrast Sensitivity Chart. The

chart was adjusted to be at approximately eye level for each subject. Chart illumination was set at 85 cd/m2, as measured by a calibrated photometer. An initial measurement of the log contrast sensitivity (lcs), without any filters, was taken with the Mentor Brightness Acuity Tester (BAT) held flush against spectacles or orbit. The BAT was set to low illumination initially.

TABLE 1

Filter #	Filter
2	NOIR 54% tlt Amber
3	NOIR 18% tlt Amber
4	NOIR 8% tlt Amber
5	NOIR 58% tlt Gray-green
6	NOIR 6% tlt Gray-green
7	NOIR 1% tlt Gray-green
8	Corning CPF 511
9	Corning CPF 527
10	Corning CPF 550
11	Opticlear anti-reflective coating

**all filters were tested for tlt initially

The Pelli-Robson Contrast Sensitivity Chart is a relatively new design developed by Dr. Dennis Pelli, Syracuse University, NY and Dr. John Robson, University of Cambridge, England. The chart consists of eight rows of six uniform, 5.2 X 5.2 cm., capital Sloan letters, arranged in triplets and varying only in contrast. Each letter subtends an angle of 3 degrees at one meter and each triplet decreases in contrast by 1.5 log units. A score is generated when two or more figures of a triplet are missed. The qualifying triplet would then be the previous triplet (where two or more letters were correct) and the lcs of the triplet is printed alongside the letters.

The Pelli-Robson Chart was selected for use in our study due to ease of use: most people are familiar with reciting the letters seen from a chart or screen. Also, it has been reported in a study by Gary Rubin, comparing the Vistech Chart, computer CRT based gratings and the Pelli-Robson Chart, that the Pelli-Robson Chart has the highest test-retest reliability factor (.98 for normal subjects). (A) Also, the Pelli-Robson Chart utilizes a

forced choice procedure, with a two of three criterion for passing, which is superior to the Vistech which utilizes a grated target in precise orientation and allows for an anonymous patient response of "blank", thus eliminating forced choice criterion, and decreasing the test-retest reliability.

The BAT was donated by Mentor and was utilized to standardize the illumination for each patient. The instrument consists of a hooded light source and a sixty mm diameter dome with a twelve mm central aperture. Three illumination settings are available to simulate specific lighting conditions. Low illumination (12 ft. lamberts) simulates bright fluorescent lighting, Medium (100 ft. lamberts) simulates a partly cloudy day at a sandy beach and high illumination (400 ft. lamberts) is compared to an intensely bright day at a sandy beach. Our subjects were tested under both low and medium illumination conditions. After an initial log contrast sensitivity measurement was taken on low illumination with no filters, the ten previously listed filters were inserted individually, between the BAT and the subject's eye and the lsc was again measured for each filter. Once each filter had been assessed, the BAT was increased to medium illumination and the measurements were taken again for each filter.

The second part to the study investigated the effects of the filters on Feinbloom visual acuity. The Feinbloom acuity chart produced by Designs for Vision, was selected because it is a mobile chart like the Pelli-Robson chart and it could be illuminated ambiently, to the same degree as the Pelli-Robson Chart.

The subject was seated twenty feet from the Feinbloom visual chart (FVA) and an initial acuity under low illumination of the BAT was taken with no filters. Then, each filter previously mentioned was inserted individually between the BAT and the patient's eye for FVA measurement. Finally, the BAT was increased to medium illumination and an initial measurement was again taken. Each filter was then tested on medium, for FVA generation. All FVA measurements were converted to their minimum angle of resolution equivalents.

RESULTS

Baseline measurements were taken without filters for lcs on low and medium illuminations and FVA on low and medium illuminations for each subject. The average baseline lcs on low illumination (with no filters) was 1.410, lcs(medium) was 1.395 FVA(low) was 1.27 and FVA(medium) was 1.175.

All filtered measurements were compared to baseline unfiltered measurements and classified as producing an effect below, the same or above the baseline reading. Bar graphs follow the report to help illustrate the findings explained below.

Filters which produced results below their comparative baseline findings, were considered first. Comparing lcs(low) data for all subjects revealed that all ten of the filters produced a decrease relative to baseline lcs(low) measurements, for at least one subject. Only 40% of the subjects showed a decreased lcs(low) with all ten filters. Filters 4 and 7 most often decreased lcs(low) values (12.05/11.45% of the time), while filter 11 least often decreased lcs(low) values, for the subject population(7.22% of the time). Below is a bar graph representing the percentage of time each filter produced a lcs(low) value lower than baseline. (see bar graph page 9).

Comparing lcs(med) values for each subject showed that each filter decreased the lcs(med) value below baseline value for at least four subjects. However, none of the subjects showed a decreased lcs(med) with all the filters. Filter 7 most often decreased lcs(med) (14.93% of the time) and filter 11 least often reduced the value for the subject population (5.97% of the time). (see bar graph page 10.)

Analyzing FVA(low) values for each subject showed that only filter 11 decreased FVA(low) but only .83% of the time. Each of the other filters decreased the FVA(low) below baseline for at least four patients (7.02% of the time). (see bar graph page 11).

Finally, reviewing FVA(med) values revealed that each filter reduced FVA(med) findings below baseline for at least four subjects each. Only 20% of the patients had a reduced FVA(med) finding below baseline with all ten filters. Filter 11 least often decreased the finding (5.07% of the time) while filters 4, 6 and 7 most often decreased the finding for the subject population (13.77. 12.32 and 13.04% of the time). (see bar graph page 12).

The second portion of our results determines which filter produced no change in baseline values for each subject. With lcs(low), only 11% of the time did a filter produce no change in baseline readings. Filter 11 most often left baseline data unchanged (23.07% of the time). (see bar graph page 5).

Lcs(med) values were equivalent to baseline measurements in all the filters except number 7 shich was measured below baseline for all subjects. Filter 8 most often produced no change in baseline lcs(med) data (17.5% of the time) followed by filters 5 and 11 at 15%. (see bar graph page 6).

FVA(low) values were unchanged over baseline only 20% of the time. Each filter produced this effect for at least one subject.

Filter 11 has most often left the baseline data unchanged (25% of the time).(see bar graph page 7).

FVA(med) values were unchanged over baseline only 22% of the time. Filter 8 and 11 most often left baseline data unchanged (22.58% of the time).

Finally, we considered filters which produced an increase over baseline values:

For lcs(low) values, all filters with the exception of filter 7 produced scores superior to baseline. Filter 11 improved values most often (37.5% of the time.) Filters 4, 7 and 9 had no increase in CSF(low). (see bar graph page 1). did this 16.7% of the time.

For lcs(med) values, all filters produced scores superior to baseline with filter # 6 and 11 increasing lcs(med) above baseline the majority of the time. (20.51/25.64% of the time). recorded. (see bar graph page 2).

For FVA(low) values, filters 2,5,8,9,10 and 11 produced scores superior to baseline, with filter 11 being the most frequently selected. Filters 3,4,6,7 did not improve FVA(low) above baseline in any subject tested. (see bar graph page 3).

Finally, FVA(med) values were improved with filters 2,5,8,9, 10 and 11, over baseline. Filter 11 most often improved the recording (41.67% of the time). (see bar graph page 4).

DISCUSSION

Contrast sensitivity has long been trying to gain acceptance in the eye care world. Contrast sensitivity function (CSF) has been recommended for use with low vision patients, cataract development, visual screenings and to monitor progressive eye diseases to name a few. One problem that has been encountered is reproducability and ease of use of CSF tests. Computer-based forced choice tests are very expensive yet accurate and Vistech sin wave grating charts have low reproducability values but is much less expensive. For the data in this study, we have used the Pelli-Robson chart that has been tested to be approximately as accurate as the CRT-based forced choice test with high levels of reproducability. The Pelli-Robson chart also is very portable and is also inexpensive. According to an article by Gary Rubin, the CRT correlate is approximately .86 and .86 for the Pelli-Robson chart (B).

In the study, patients seemed to respond well to the Pelli-Robson chart; most subjects never seeing the chart previously. This test tends to be easier to administer compared to the Vistech due to the fact patients are better at reading letters than sin waves. CSF is also a good test to follow visual problems which may not affect visual acuity directly but may decrease CSF.(C) CSF testing has been found to be highly reproducable and this helps to increase our confidence in using CSF to follow and monitor certain non-macular vision.

In 1986, Joseph Maino, O.D., and Timothy McMahon, O.D., did research on the preference of specific NOIR lenses with particular ocular diseases. Based on their data, it appears that these pateints preferred the 101 (10%) Medium Amber filter, followed by the Medium Green-Gray (18%) filter (D). We have to remember this study was with people with ocular pathology. In our study, we found patients to prefer filter 11, which was the Opticlear antireflective coating, to increase CSF and acuity. The tinted filters most likely to increase CSF and acuity was filter number 6, the NOIR 6% tlt gray-green filter followed by filter 8, the CPF 511 and 5, the NOIR 58% tlt gray-green.

The use of filters can help to decrease certain glare problems. Many practitioners will prescribe lenses based on one prominent color such as "amber". This can lead to problems because some lenses may appear a certain color due to the dominant wavelength but may admit light in the ultraviolet and invisible violet region that can cause glare (E). Our study does test the CPF 511, 527, 550 series which have a dominant yellow-orange color and it seems as though the CPF 511 tends to increase visual acuity and CSF to the greatest degree but is followed closely by the 527. Even though they all have a common dominant wavelength, patients usually tend to prefer one over another. The best test is to try each filter that may assist the patient based on their acuity and pathology.

Based on the analysis of the data, it appears as though patient's do respond favorably to the Opticlear anti-reflective coating with a definitive increase in CSF (low and medium) and FVA (low and medium). Filter 6, the NOIR 6% gray-green was also viewed favorably, especially in the medium lighting environment with contrast sensitivity but did surprisingly lower in FVA low and and medium.

The darker tints, not surprisingly, did exhibit a decrease in both CSF and FVA in low and medium lighting. Filter 4, the NOIR 8% tlt amber and NOIR 1% tlt gray-green were two of the three darkest tints. It was odd that filter 6 was preferred to increase CSF (med) but decreased FVA (low and medium). The #6 filter being the NOIR 6% gray-green.

CONCLUSION:

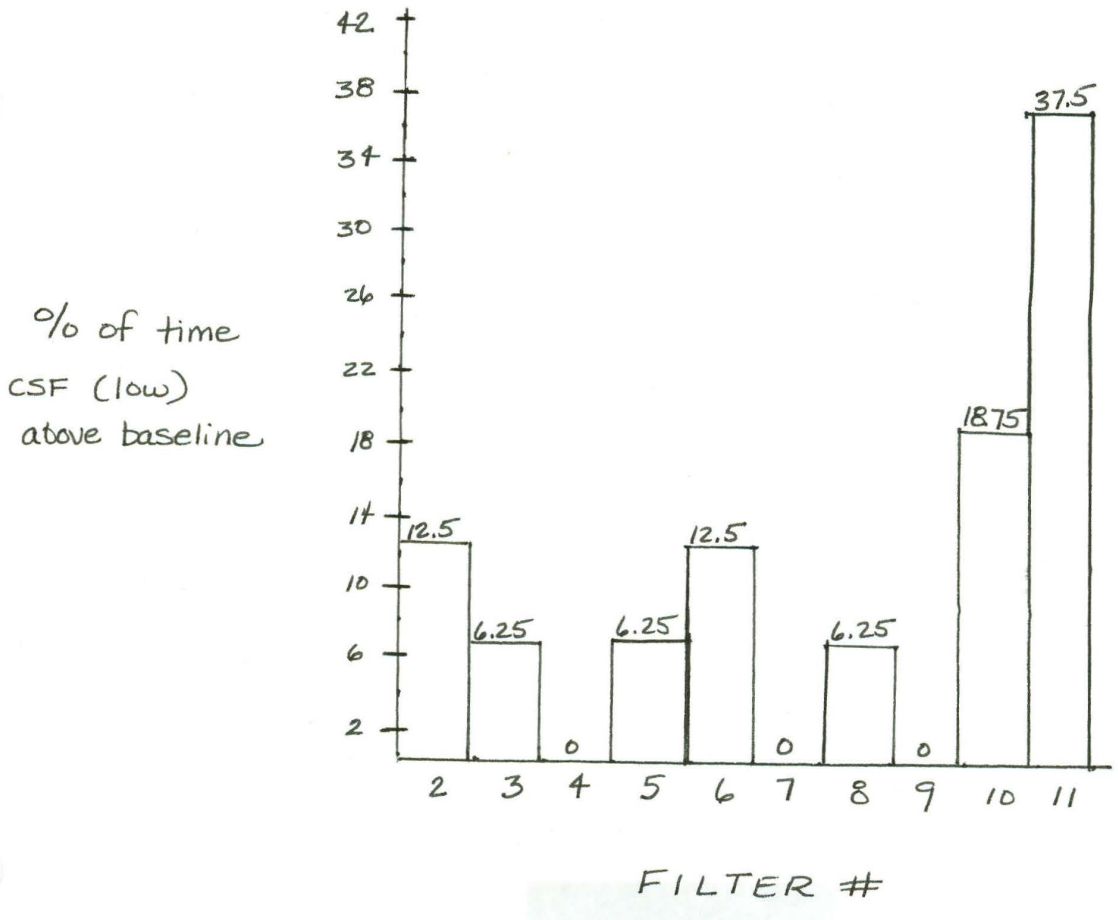
In conclusion, we have found that (1) the Pelli-Robson chart is a viable alternative to previous constrast sensitivity testing and patients tend to respond well to these charts. The B.A.T. was also invaluable for keeping the testing environment consistent. (2) Most importantly, we have found that patients do prefer certain filters.

It is our duty as eye care professionals to offer certain tints to our patients to possibly increase their CSF and acuity in certain environments. The Opticlear antirefe=lective coating definately increased both CSF and FVA in this testing situation. Gray-green filters seemed to be preferred for patient comfort in our study but to keep in mind the research was performed on normal patients without pathology of the eye. We should keep in mind the darker tints may decrease both CSF and FVA and should be suggested in only certain situations.

This research project would be of greater value if a population of low vision patients were tested with pathological eyes but we do feel it is of importance to test if one "prominent" filter or color does or does not help to improve FVA or CSF in a normal population.

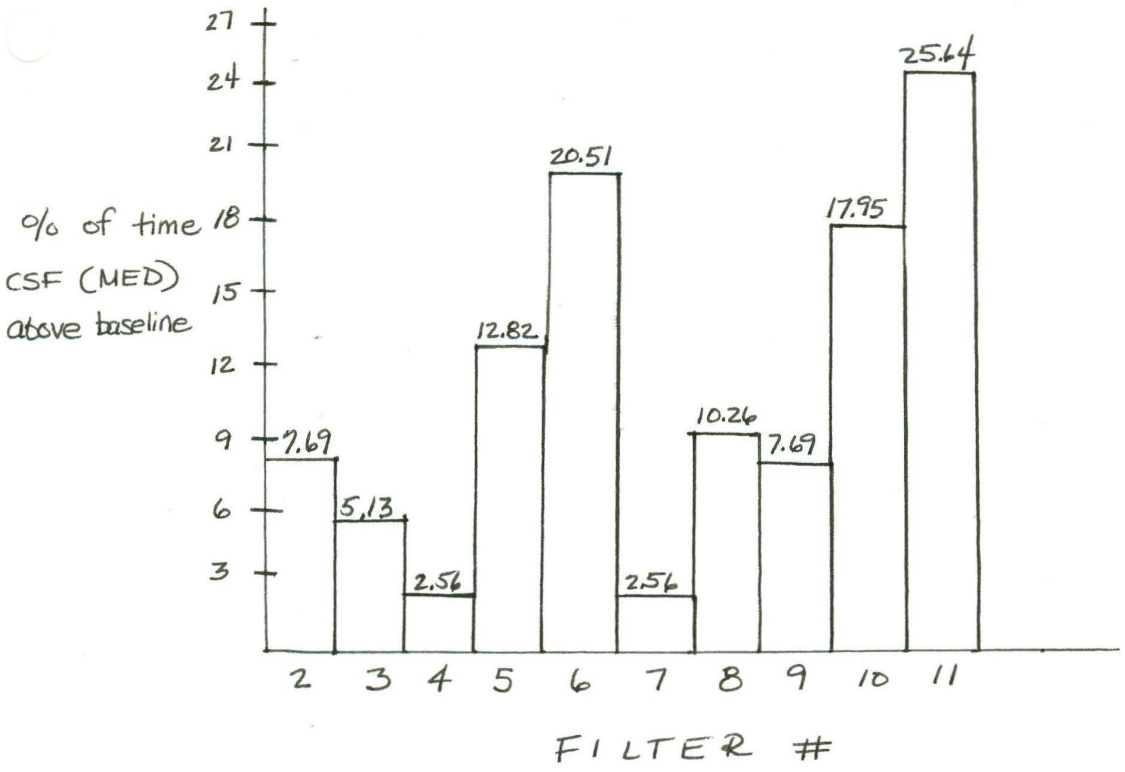
SUMMARY

Tints and filters are a very important part of the eye care profession. The lighter NOIR tints, especially the gray-green tints, seem to help non-pathological eyes to slightly increase FVA and CSF. The antireflective coating can also be suggested to the patient to help FVA and CSF. The changes that these two particular lenses have on vision are slight but based on our research, they do seem to be preferred in certain individuals.



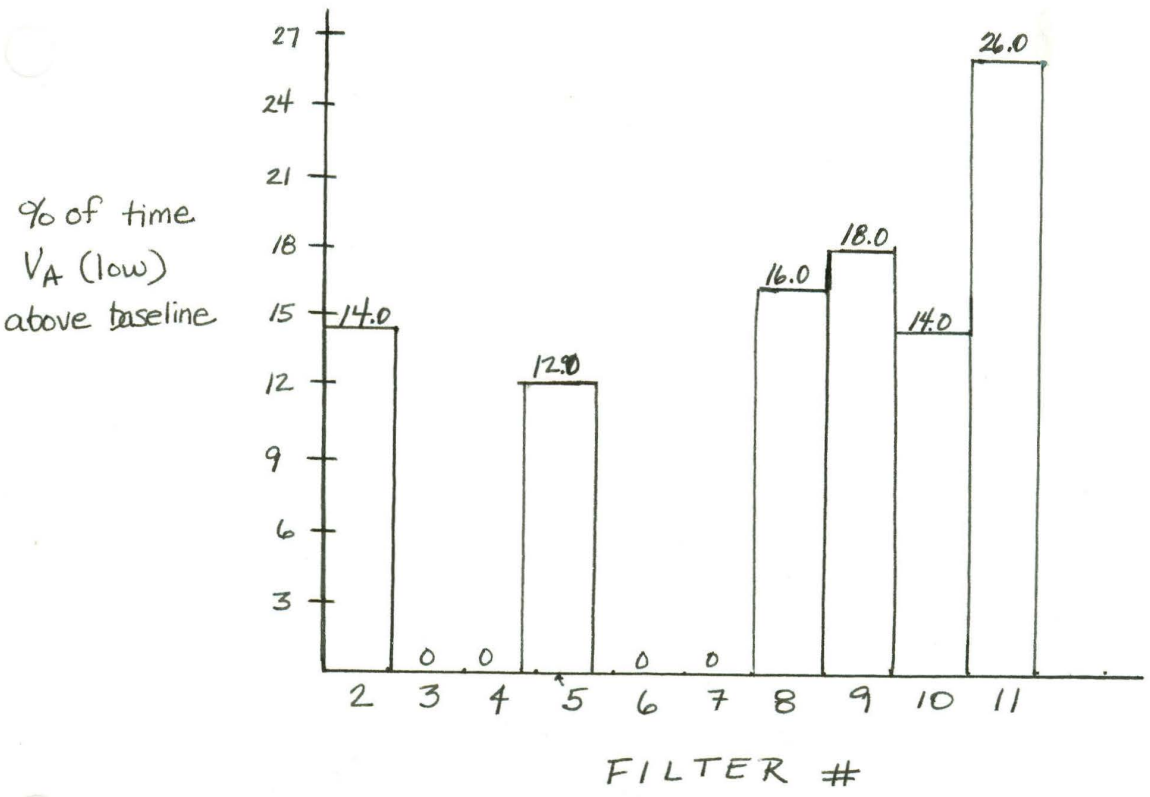
Filter #11 – 37.5% of the time showed an increase in CSF (low) above the baseline CSF (low) figure.

Filters #4, 7, 9 – did not increase CSF above baseline



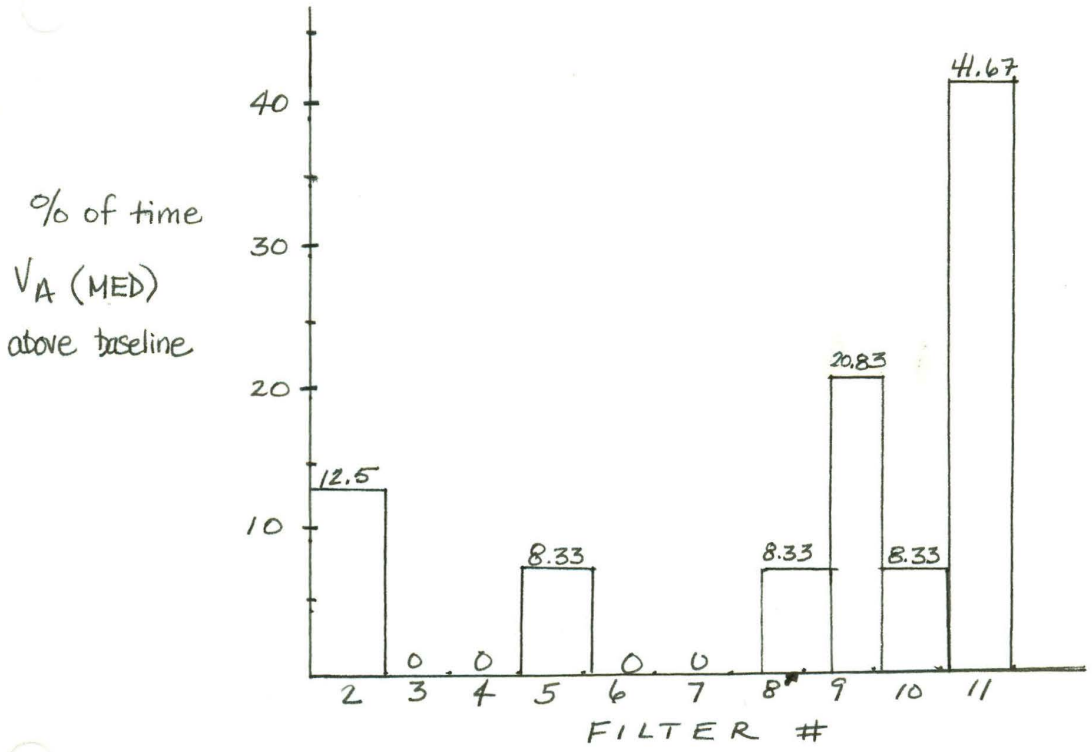
Filters #6 + 11 = increased CSF (MED) above baseline the majority of the time.

Filters #4 + 7 = increased CSF (MED) above baseline the least.



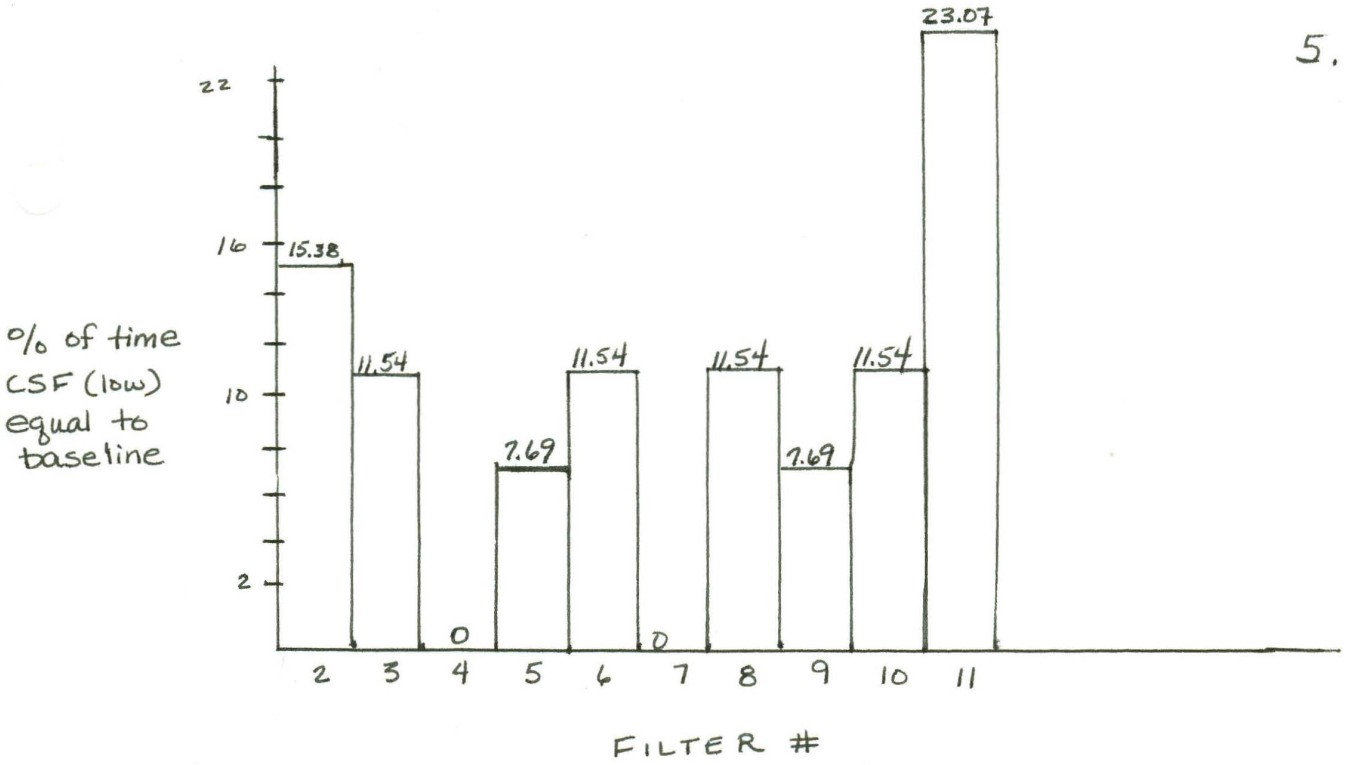
Filter #11 = increased V_A (low) above baseline the most.

Filters #3, 4, 6, 7 = did not improve V_A (low) above baseline.

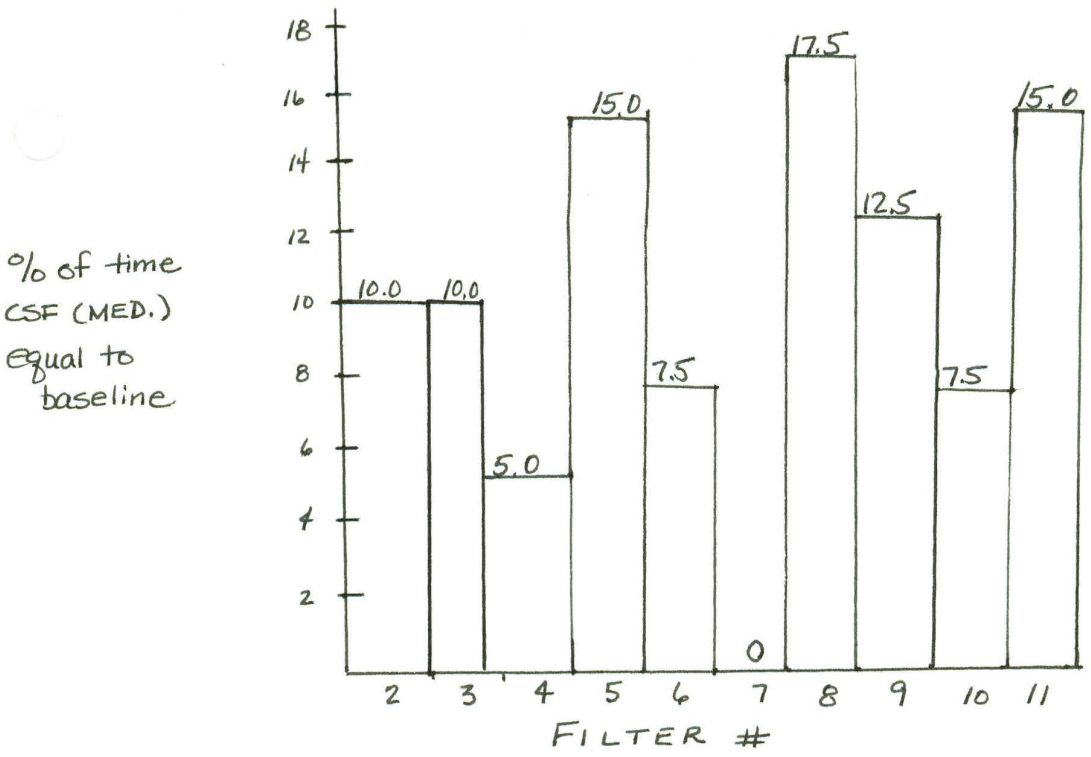


Filter # 11 = increased V_A (MED) above baseline the majority.

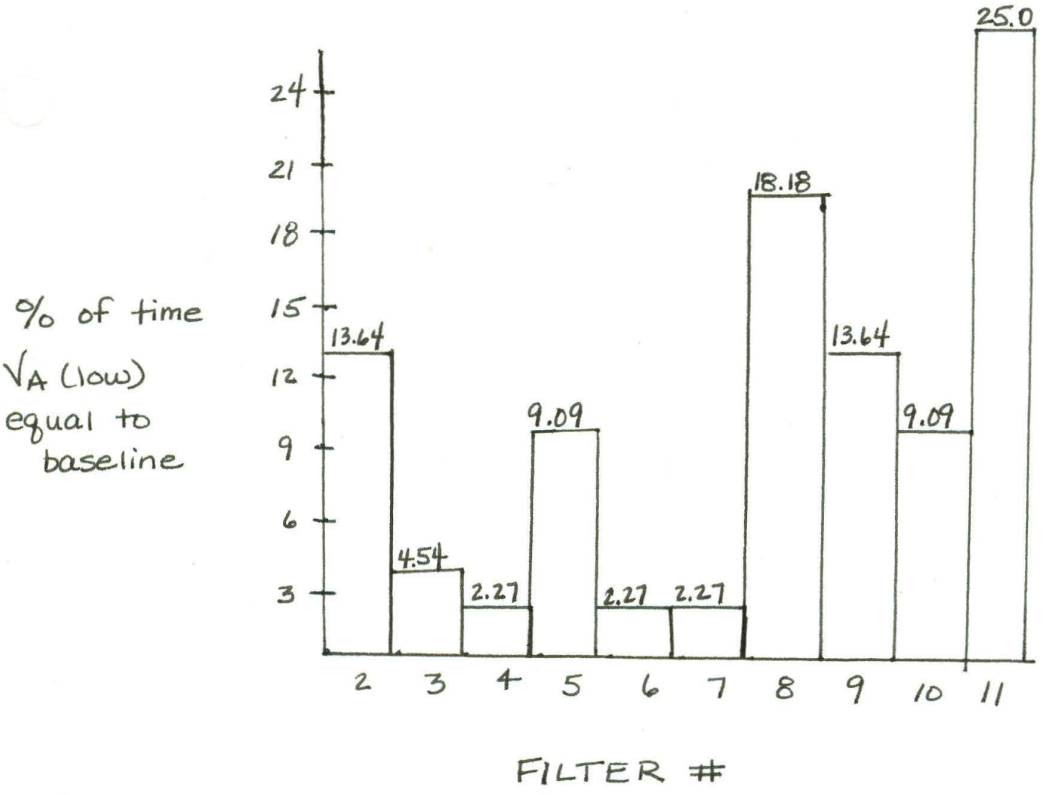
Filters 3, 4, 6, 7 = did not improve V_A (MED) above baseline.



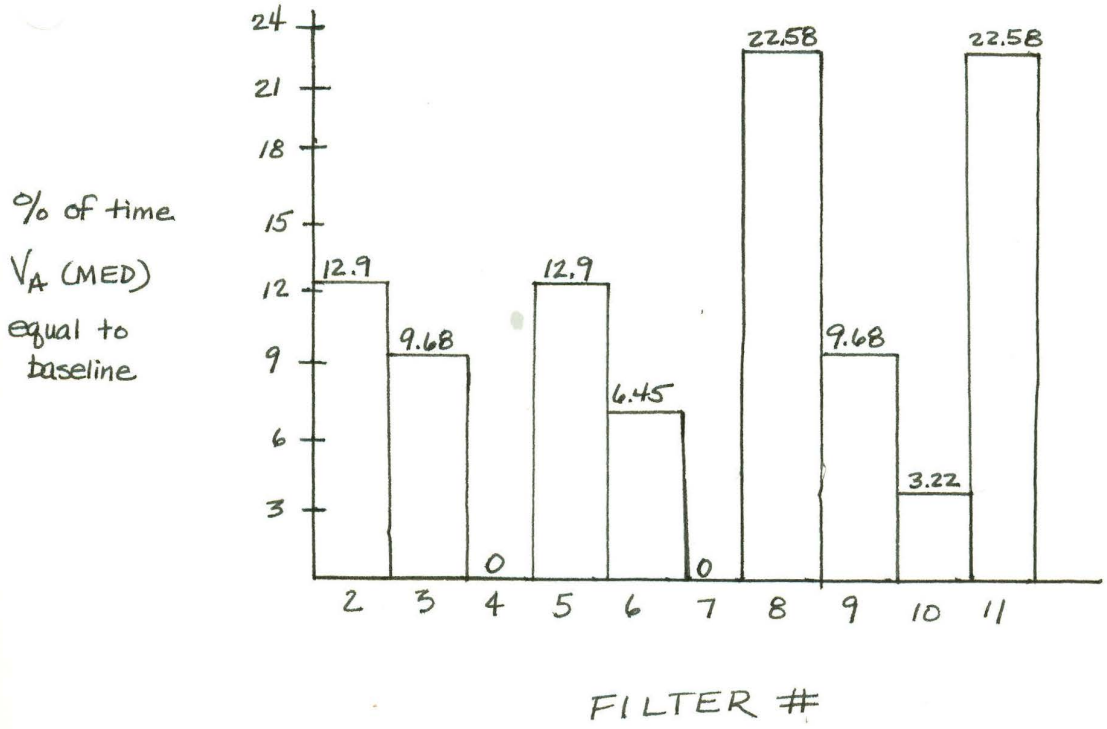
Filter #11 was most frequently equal to baseline CSF (low)



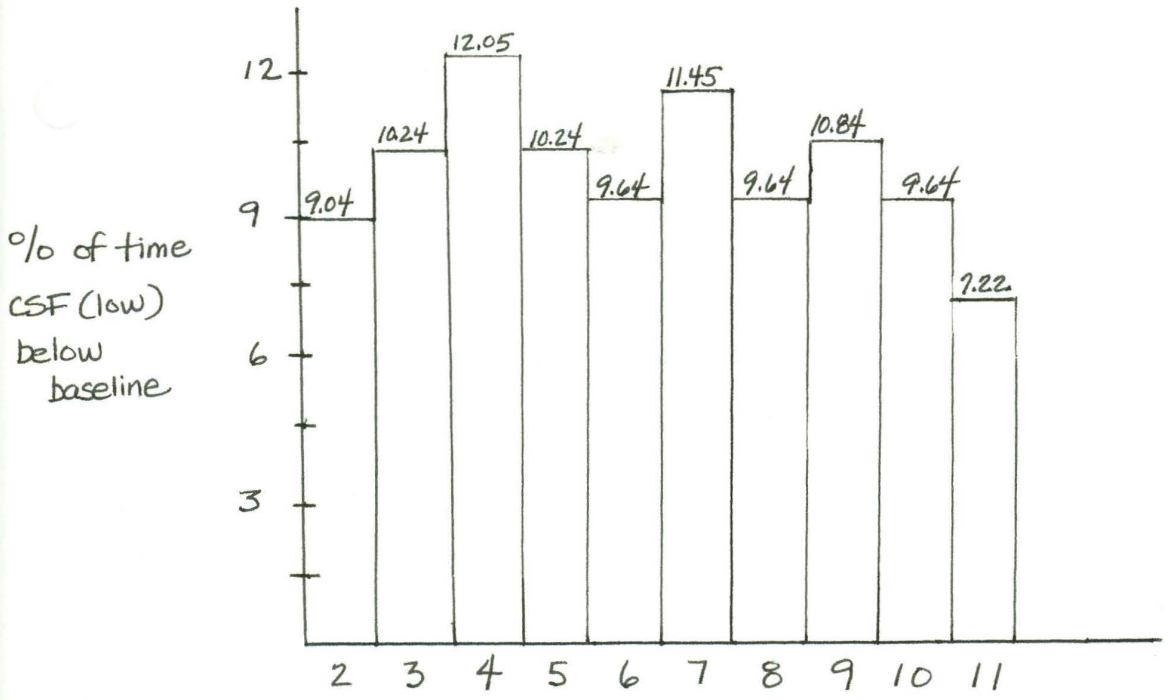
Filters # 5, 8, 11 = most frequently equal to baseline CSF (MED).



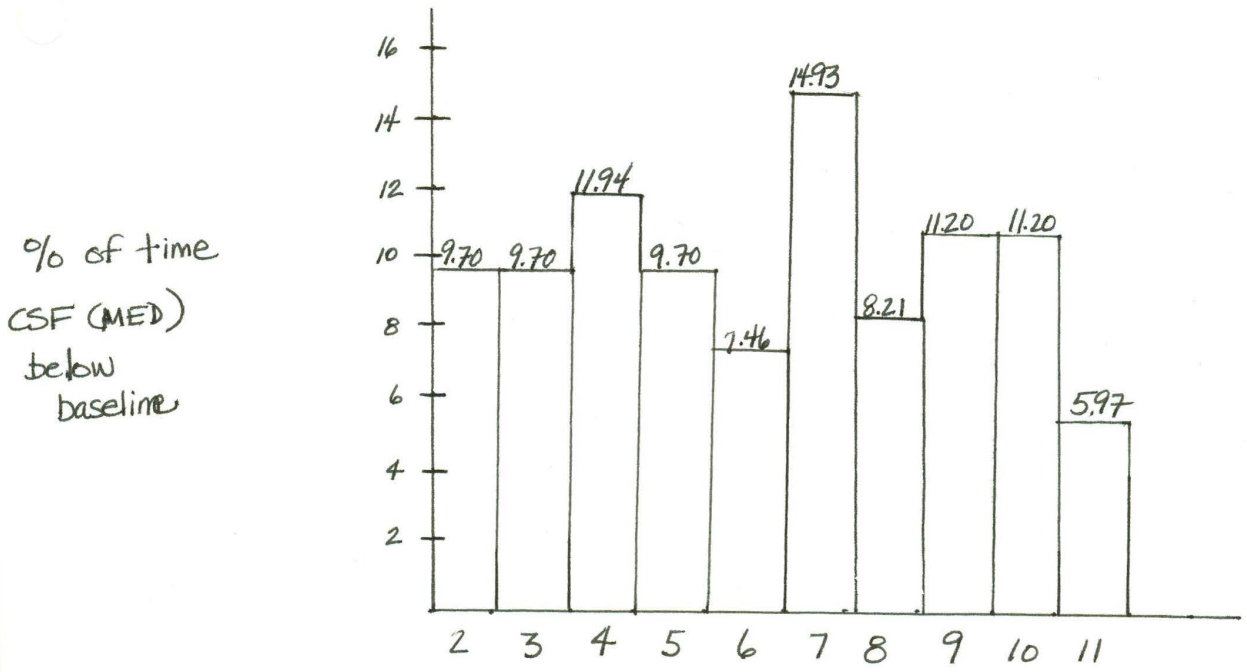
Filter # 11 = most frequently equal to baseline V_A (LOW).



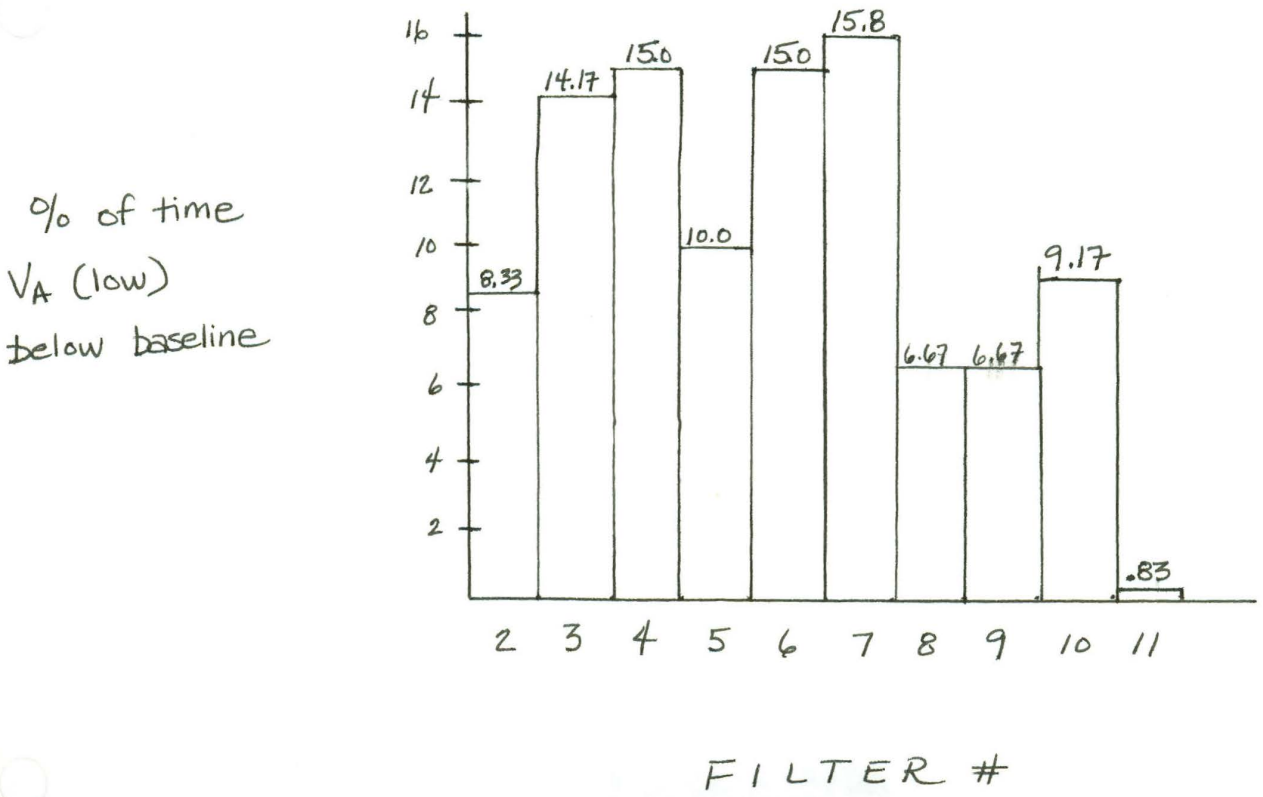
Filters 8 + 11 = most frequently equal to baseline V_A (MED).



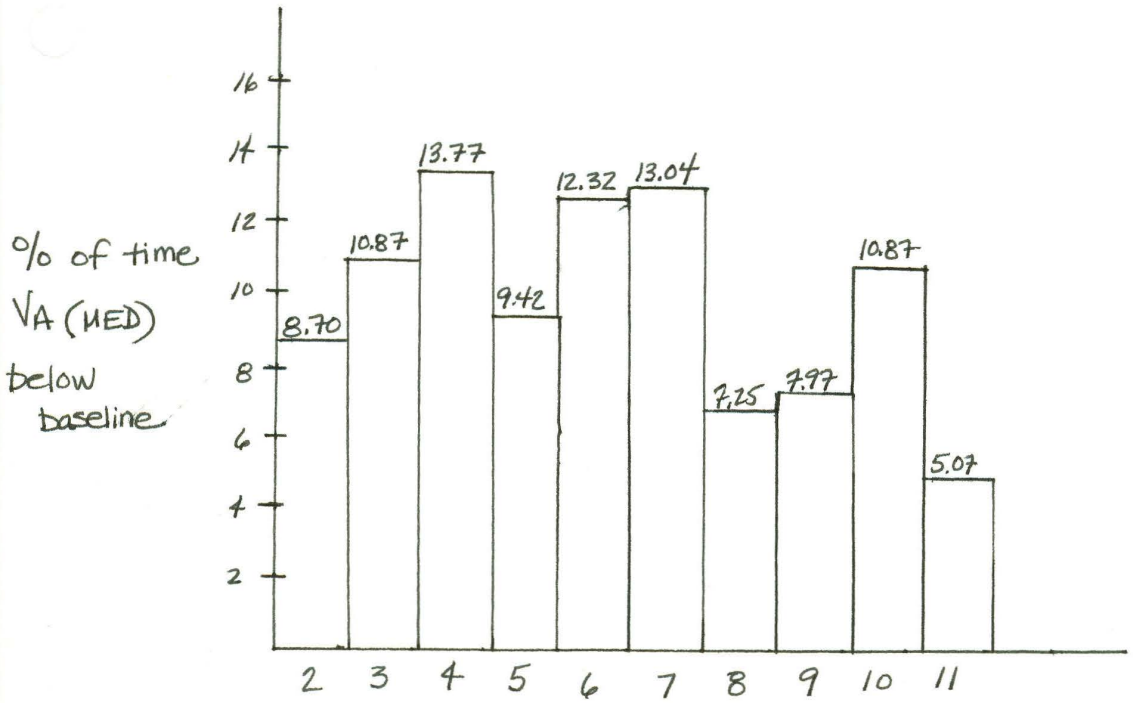
FILTERS # 4 + 7 = decreased CSF (low) below baseline the most.



Filter #7 = decreased CSF (MED) below baseline most frequently.



Filters # 4, 6, 7 = decreased V_A (low) below baseline most frequently.



Filter # 4, 6 and 7 decreased V_A(MED) below baseline V_A (MED) the most.

(1)

PATIENT: N. clancy
DOB: 3-24-65
(OD) OS
PATHOLOGY: None
RX: -.50 -.50 x 180.
VA 20/20 (snellen)

1	1.65	A	1.5		
2	1.35	B	1.65		
3	1.50	C	1.5	CSF low	
4	1.35	D	1.35	CSF Med	
5	1.65	E	1.5		
6	1.8	F	1.65		
7	.9	G	1.05		
8	1.65	H	1.35		
9	1.65	I	1.35		
10	.45	J	1.65		
11	1.8	K	1.65		
12	1.0	L	1.0		
13	1.25	M	1.0	VA Low	
14	1.0715	N	1.0	VA med.	
15	1.4583	O	1.25		
16	1.0357	P	1.0		
17	1.0	Q	1.0		
18	1.0	R	3.0		
19	1.0	S	1.0		
20	1.0	T	1.2917		
21	3.0	U	1.3334		
22	1.0	V	1.0		

COMMENTS:

MJS

(2)

PATIENT: B. Atkinson
DOB: 8-9-65
OD/(OS)
PATHOLOGY: None
RX: -4.75 -.75 x 110
VA 20/20 (snellen)

(1)

1	1.95	A	1.65
2	1.5	B	1.35
3	1.65	C	.9
4	1.2	D	.45
5	1.8	E	1.5
6	1.65	F	1.05
7	~~0~~	G	~~0~~
8	1.95	H	1.5
9	1.65	I	1.35
10	1.65	J	1.2
11	1.8	K	1.65
12	1.0	L	1.0
13	1.0	M	1.1786
14	1.2917	N	1.7
15	1.3334	O	4.333
16	1.1429	P	1.0715
17	1.1782	Q	1.7
18	3.0	R	3.25
19	1.0357	S	1.0
20	1.2142	T	1.0715
21	1.0715	U	1.1072
22	1.0	V	1.0357

COMMENTS:

(3)

PATIENT: B. Baize
DOB: 4-27-64
(OD) OS
PATHOLOGY: None
RX: +.75 -.75 x 10
VA 20/15 (snellen)

1	1.8	A	1.65
2	1.65	B	1.35
3	1.65	C	1.5
4	1.5	D	1.35
5	1.65	E	1.35
6	1.65	F	1.65
7	1.05	G	1.05
8	1.5	H	1.35
9	1.5	I	1.35
10	1.65	J	1.35
11	1.65	K	1.5
12	1.0	L	1.0
13	1.2917	M	1.0715
14	1.25	N	1.2917
15	1.6	O	1.8
16	1.2917	P	1.0357
17	1.5	Q	1.2142
18	2.75	R	3.5
19	1.375	S	1.0357
20	1.6	T	1.0357
21	1.8	U	1.7
22	1.0	V	1.2917

COMMENTS:

(4)

PATIENT: S. Kensok
DOB: 3-26-65
(OD) OS
PATHOLOGY: None
RX: -3.25 -.50 x 35
VA 20/15 (snellen)

2

1	1.65	A	1.65
2	1.65	B	1.35
3	1.65	C	1.5
4	1.5	D	1.5
5	1.65	E	1.5
6	1.65	F	1.5
7	1.35	G	1.05
8	1.65	H	1.65
9	1.65	I	1.35
10	1.65	J	1.35
11	1.65	K	1.5
12	1.0	L	1.0357
13	1.0357	M	1.0
14	1.1786	N	1.1786
15	1.2142	O	1.4167
16	1.0	P	1.0357
17	1.0715	Q	1.1072
18	2.6	R	3.75
19	1.0357	S	1.0357
20	1.0	T	1.0
21	1.0715	U	1.1072
22	1.0	V	1.0357

COMMENTS:

(5)

PATIENT: V. Badgett
DOB: 2-7-65
(OD) OS
PATHOLOGY: None
RX: -1.75 -.75 x 95
VA 20/15

1	1.8	A	1.35
2	1.65	B	1.35
3	1.65	C	1.35
4	1.65	D	1.35
5	1.65	E	1.35
6	1.5	F	1.5
7	1.05	G	1.05
8	1.35	H	1.35
9	1.5	I	1.35
10	1.5	J	1.20
11	1.5	K	1.35
12	1.0357	L	1.0357
13	1.0357	M	1.0357
14	1.0357	N	1.0357
15	1.0357	O	1.0715
16	1.0357	P	1.0357
17	1.0357	Q	1.0357
18	2.6	R	2.6
19	1.0357	S	1.0357
20	1.0	T	1.0
21	1.0	U	1.0357
22	1.0	V	1.0

COMMENTS:

(6)

PATIENT: M. Mathews
DOB: 4-27-65
(OD) OS
PATHOLOGY: None
RX: -1.00
VA 20/15 (snellen)

3

1	1.8	A	1.65
2	1.65	B	1.35
3	1.5	C	1.5
4	1.65	D	1.5
5	1.65	E	1.35
6	1.5	F	1.35
7	1.20	G	1.05
8	1.5	H	1.65
9	1.65	I	1.35
10	1.5	J	1.65
11	1.65	K	1.65
12	1.0715	L	1.0
13	1.1072	M	1.0357
14	1.1786	N	1.3334
15	1.2142	O	1.3334
16	1.0357	P	1.0715
17	1.2917	Q	1.1072
18	3.0	R	3.5
19	1.0	S	1.0
20	1.0	T	1.0357
21	1.0715	U	1.0715
22	1.0357	V	1.0

COMMENTS:

(7)

PATIENT: D. Mitchell
DOB: 12-22-55
(OD)/OS
PATHOLOGY: None
RX: -2.25
VA 20/20 (snellen)

1	1.65	A	1.35
2	1.65	B	1.35
3	1.5	C	1.5
4	1.35	D	1.35
5	1.65	E	1.35
6	1.5	F	1.2
7	1.2	G	.9
8	1.5	H	1.2
9	1.5	I	1.2
10	1.5	J	1.05
11	1.35	K	1.2
12	1.1428	L	1.1072
13	1.1072	M	1.1428
14	1.2917	N	1.375
15	1.6	O	1.2
16	1.0357	P	1.1786
17	1.3334	Q	1.3334
18	3.25	R	4.0
19	1.0	S	1.3334
20	1.0357	T	1.4167
21	1.0	U	1.375
22	1.0715	V	2.0

COMMENTS:

(8)

PATIENT: J. LaMarr
DOB: 3-31-65
(OD)/OS
PATHOLOGY: None
RX: -3.50 -.50 x 165
VA 20/15-2 (snellen)

(4)

1	1.65	A	1.35
2	1.5	B	1.35
3	1.65	C	1.35
4	1.5	D	1.2
5	1.5	E	1.2
6	1.35	F	1.2
7	1.05	G	.75
8	1.65	H	1.35
9	1.5	I	1.2
10	1.5	J	1.05
11	1.35	K	1.35
12	1.0715	L	1.1072
13	1.0357	M	1.1072
14	1.0715	N	1.3334
15	1.0715	O	1.6
16	1.0357	P	1.1428
17	1.2142	Q	1.3334
18	3.0	R	4.0
19	1.0	S	1.1428
20	1.0	T	1.1072
21	1.0357	U	1.0715
22	1.0	V	1.0

COMMENTS:

(9)

PATIENT: H. Johnson
DOB: 12-24-65
(OD) OS
PATHOLOGY: None
RX: -4.25 -.50 x 95.
VA 20/15

1	1.95	A	1.5
2	1.65	B	1.35
3	1.65	C	1.5
4	1.65	D	1.5
5	1.65	E	1.65
6	1.65	F	1.65
7	1.2	G	1.05
8	1.65	H	1.5
9	1.65	I	1.5
10	1.65	J	1.35
11	1.65	K	1.5
12	1.2917	L	1.2917
13	1.25	M	1.25
14	1.4583	N	1.5
15	1.7	O	2.0
16	1.4167	P	1.2142
17	1.6	Q	1.6
18	3.0	R	3.5
19	1.3334	S	1.4167
20	1.4583	T	1.25
21	1.1072	U	1.1786
22	1.0715	V	1.0715

COMMENTS:

(10)

PATIENT: L. Hajec
DOB: 6-23-66
(OD) OS
PATHOLOGY: None
RX: -4.00 -.25 x 155
VA 20/15 (Snellen)

(5)

1	1.65	A	1.35
2	1.65	B	1.35
3	1.65	C	1.5
4	1.5	D	1.35
5	1.65	E	1.35
6	1.65	F	1.5
7	1.35	G	1.05
8	1.65	H	1.35
9	1.5	I	1.35
10	1.5	J	1.35
11	1.65	K	1.35
12	1.0	L	1.0357
13	1.0357	M	1.0357
14	1.25	N	1.2917
15	1.25	O	1.3334
16	1.0357	P	1.0715
17	1.1072	Q	1.1072
18	2.0	R	2.0
19	1.0	S	1.0715
20	1.0357	T	1.0357
21	1.0357	U	1.1786
22	1.0	V	1.1072

COMMENTS:

(1)

PATIENT: Maribeth Cherry
DOB: 09-18-63
(OD)/OS
PATHOLOGY: none
RX: none
VA 20/20

1	1.50	A	.90
2	1.35	B	1.05
3	1.35	C	.90
4	1.05	D	.75
5	1.35	E	.90
6	1.35	F	1.05
7	.45	G	.15
8	1.35	H	.90
9	1.35	I	.90
10	1.35	J	.90
11	1.65	K	1.05
12	1.00	L	1.30
13	1.40	M	1.50
14	1.60	N	1.55
15	1.90	O	2.95
16	1.40	P	1.25
17	1.90	Q	1.55
18	6.00	R	46.67
19	1.15	S	~~46.67~~ 1.55
20	1.15	T	1.25
21	1.10	U	1.10
22	1.05	V	1.15

COMMENTS:

(2)

PATIENT: Matt Maki
DOB: 09-05-65
(OD)/OS
PATHOLOGY: none
RX: -2.00 -1.25 x080
VA 20/20

(6)

1	1.50	A	.90
2	1.35	B	.90
3	1.35	C	.75
4	1.20	D	.75
5	1.20	E	.90
6	1.20	F	.75
7	.45	G	.15
8	1.35	H	.90
9	1.35	I	.75
10	1.35	J	.90
11	1.50	K	.90
12	1.00	L	1.00
13	1.00	M	1.25
14	1.35	N	2.10
15	1.55	O	3.00
16	1.00	P	1.25
17	1.35	Q	2.10
18	4.05	R	40.00
19	1.00	S	1.25
20	1.00	T	1.25
21	1.00	U	1.25
22	1.00	V	1.00

COMMENTS:

(3)

PATIENT: Mary Jo Horn
DOB: 06-29-63
(OD)/OS
PATHOLOGY: none
RX: +1.00 DS
VA 20/20

1	1.35	A	.90
2	1.35	B	.75
3	1.35	C	.75
4	1.05	D	.75
5	1.35	E	.90
6	1.35	F	.90
7	.75	G	.30
8	1.20	H	.75
9	1.20	I	.60
10	1.20	J	.75
11	1.35	K	.75
12	1.00	L	1.00
13	1.00	M	1.50
14	1.05	N	1.50
15	1.30	O	1.95
16	1.00	P	1.55
17	1.05	Q	1.55
18	3.00	R	30.00
19	1.05	S	1.40
20	1.00	T	1.60
21	1.00	U	1.55
22	1.00	V	1.25

COMMENTS:

(4)

PATIENT: Amy Keller
DOB: 11-15-66
(OD)/OS
PATHOLOGY: none
RX: +.75 DS
VA 20/20

7

1	1.50	A	1.05
2	1.35	B	.75
3	1.35	C	.75
4	1.20	D	.75
5	1.35	E	.90
6	1.35	F	1.05
7	.45	G	.15
8	1.35	H	.75
9	1.35	I	.75
10	1.20	J	.75
11	1.35	K	1.05
12	1.00	L	1.05
13	1.00	M	1.35
14	1.30	N	1.30
15	1.40	O	2.10
16	1.05	P	1.15
17	1.15	Q	1.65
18	5.00	R	35.00
19	1.00	S	1.55
20	1.00	T	1.90
21	1.15	U	2.00
22	1.00	V	1.15

COMMENTS:

5

PATIENT: Jackie Warner
DOB: 07-02-60
(OD)/OS
PATHOLOGY: none
RX: −3.25 DS
VA 20/20⁻²

1	1.35	A	.75		
2	1.05	B	.60		
3	.90	C	.45		
4	.90	D	.35		
5	1.05	E	.75		
6	.90	F	.60		
7	.15	G	.30		
8	1.05	H	.75		
9	1.05	I	.75		
10	1.05	J	.60		
11	1.20	K	.75		
12	1.50	L	2.00		
13	2.10	M	3.95		
14	3.00	N	4.00		
15	3.05	O	4.05		
16	2.10	P	3.00		
17	2.05	Q	3.05		
18	10.00	R	35.00		
19	3.00	S	3.05		
20	1.40	T	3.00		
21	1.40	U	3.95		
22	1.30	V	2.05		

COMMENTS:

6

PATIENT: Angi Gatlin
DOB: 05-03-66
(OD)/OS
PATHOLOGY: none
RX: +.50 DS
VA 20/20⁻¹

1	1.65	A	1.35		
2	1.50	B	1.20		
3	1.35	C	1.20		
4	1.35	D	1.05		
5	1.50	E	1.05		
6	1.35	F	1.05		
7	.60	G	.30		
8	1.50	H	1.05		
9	1.50	I	1.05		
10	1.65	J	1.20		
11	1.65	K	1.20		
12	1.05	L	1.10		
13	1.00	M	1.25		
14	1.25	N	1.30		
15	1.40	O	2.00		
16	1.15	P	1.15		
17	1.10	Q	1.90		
18	8.00	R	15.00		
19	1.05	S	1.10		
20	1.10	T	1.00		
21	1.15	U	1.15		
22	1.00	V	1.10		

COMMENTS:

8

(7)

PATIENT: Rhonda Graham
DOB: 9-17-66
(OD)/OS
PATHOLOGY: none
RX:
VA 20/20

1	1.65	A	.90
2	1.50	B	.75
3	1.35	C	.75
4	1.20	D	.75
5	1.35	E	.75
6	1.35	F	.75
7	.60	G	.45
8	1.20	H	.75
9	1.35	I	.75
10	1.20	J	.75
11	1.50	K	.90
12	1.00	L	1.35
13	1.15	M	1.55
14	1.25	N	2.95
15	1.35	O	3.10
16	1.05	P	1.55
17	1.35	Q	3.00
18	3.00	R	9.00
19	1.00	S	1.35
20	1.00	T	1.55
21	1.05	U	1.45
22	1.00	V	1.40

COMMENTS:

(8)

PATIENT: Pam Sankey
DOB: 09-20-61
(OD)/OS
PATHOLOGY: none
RX: -4.00 -1.75 x 005
VA 20/20

1	1.50	A	1.20
2	1.20	B	1.05
3	1.20	C	.90
4	1.20	D	.90
5	1.35	E	1.05
6	1.35	F	.90
7	.45	G	.15
8	1.20	H	1.05
9	1.35	I	1.05
10	1.50	J	1.05
11	1.50	K	1.05
12	1.00	L	1.15
13	1.15	M	1.40
14	1.25	N	2.00
15	1.90	O	3.00
16	1.10	P	1.20
17	1.35	Q	1.90
18	9.00	R	17.50
19	1.00	S	1.40
20	1.05	T	1.60
21	1.35	U	1.40
22	1.00	V	1.15

COMMENTS:

(9)

(9)

PATIENT: Lynda Stahl
DOB: 07-13-66
OD/(OS)
PATHOLOGY: high mixed astigmat
RX: +5.00 ○ -8.25 x175
VA 20/20

1	1.35	A	.75
2	1.35	B	.75
3	1.20	C	.75
4	1.05	D	.75
5	1.20	E	.90
6	1.35	F	.90
7	.45	G	.15
8	1.20	H	.90
9	1.35	I	.90
10	1.35	J	.90
11	1.35	K	.75
12	1.10	L	1.35
13	1.10	M	1.40
14	1.35	N	2.05
15	1.60	O	3.05
16	1.05	P	1.45
17	1.55	Q	2.00
18	4.95	R	60.00
19	1.05	S	1.35
20	1.05	T	1.35
21	1.10	U	1.50
22	1.05	V	1.30

COMMENTS:

PC

(10)

PATIENT: Robert Farrell
DOB: 01-10-65
(OD)/OS
PATHOLOGY: none
RX: -.75 DS
VA 20/20

(10)

1	1.65	A	1.05
2	1.20	B	.75
3	1.35	C	.90
4	1.20	D	.60
5	1.35	E	.90
6	1.35	F	.90
7	.60	G	.15
8	1.50	H	.90
9	1.20	I	.75
10	1.35	J	.75
11	1.50	K	1.05
12	1.00	L	1.60
13	1.10	M	1.35
14	1.20	N	1.60
15	1.40	O	2.95
16	1.15	P	1.60
17	1.40	Q	2.05
18	9.00	R	15.00
19	1.05	S	1.45
20	1.10	T	2.00
21	1.10	U	1.40
22	1.00	V	1.50

COMMENTS:

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