A CASE STUDY OF THE SENILE MACULAR DEGENERATION PATIENT

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Jeff Natchez
Walter Betts, O.D.
Robert L. Carter, O.D.

A B S T R A C T

This paper centers on the senile macular degeneration patient. Data were collected from the files of 113 SMD patients seen in the Ferris State Optometry Clinic. An analysis of the data was done, and important facts and correlations are reported.

INTRODUCTION

Senile macular degeneration (SMD) is a common retinal disease of the aging. There presently is no medical or surgical treatment to prevent or cure this potentially vision-threatening disease. Once vision is affected and conventional spectacles no longer provide adequate functional vision, low vision aids may provide the SMD patient with the visual potential to perform those tasks he/she desires. In this paper, an attempt is made to better understand SMD, first with an explanation of the disease process itself and next with a report of the clinical findings in the examination of the SMD patients at the Ferris State College of Optometry.

SMD is an acquired macular disease common in patients over age 60. In the Framingham Eye Study (1973-1975), 2477 individuals underwent an ophthalmologic evaluation. The ages of those examined ranged from 52 to 85 years. The overall prevalence of SMD was 8.8%. The prevalence for the 52-64 year-old group was 1.6%, for the 65-74 year-old group 11.0%, and for the 75-85 year-old group 27.9%. [1]

The cause of SMD is unknown, but many contributing factors are possible. The changes in the choriocapillaris in patients with SMD may be due to agonal changes associated with the following: 1) the general diseases of diabetes mellitus, arteriosclerosis, chronic hypertension, kidney disease, and neurologic conditions; 2) prolonged or excessive exposure to bright lights; 3) autoimmune factors. [2]

The predilection of this degenerative disease for the macular region is probably due to the unique structure of the underlying choroidal vascular system. As a result of the greater hemodynamic stress on the choriocapillaris under the macular area, this region is often affected more by any disease of the choriocapillaris. [3]

Choroidal diseases cause loss of retinal function in the macular region by reduction of blood flow within the choriocapillaris or by exudative and hemorrhagic detachment of the pigment epithelium or sensory retina. The outer half of the retina almost totally depends upon the diffusion of nutrients from the choriocapillaris. Changes in Bruch's membrane and/or the pigment epithelium can result in loss of function for the outer retinal layers. [3]

Gradual obliteration of the choroidal vessels, resulting in chronic ischemia, may lead to progressive atrophy of the overlying retina and hence to deterioration of vision in that region. Loss of central vision most often occurs as a result of serous and hemorrhagic macular detachment. [3]

SMD can be broken down into four stages or types: non-exudative, exudative, atrophic, and fibrotic. A patient may progress from one stage to another, but may also stay at any stage and not progress any further.

Non-exudative SMD is characterized by drusen in the macular area. Drusen are focal collections of eosinophilic, homogenous material between the basement membrane of the pigment epithelium and the collagenous part of Bruch's membrane. They actually result in focal detachments of the pigment epithelium, with resultant thinning and depigmentation of the overlying pigment epithelium. [4]

When non-exudative SMD progresses, it more commonly leads to exudative SMD. Most eyes with SMD have a diffuse thickening of the inner aspect of Bruch's membrane. This change appears to be the predisposing factor to the splitting of Bruch's membrane and secondary serous and/or hemorrhagic detachment of the pigment epithelium and choroidal neovascularization. With the splitting, choroidal vessels can enter between the pigment epithelium and Bruch's membrane. Often these neovascular membranes leak and bleed, causing serous or hemorrhagic detachment

of the pigment epithelium. [4]

Non-exudative SMD may also progress directly to atrophic SMD. One result of drusen is loss of pigment epithelium, leading to atrophy. When this occurs, the drusen may disappear along with the overlying photoreceptors, since they are metabolically dependent upon the pigment epithelium. [4]

Exudative SMD may lead to either atrophic or fibrotic SMD. If it progresses to atrophic SMD, the pigment epithelium over the exudative areas often develops clumping, hypertrophy, and atrophy. The overlying neurosensory cells of the retina undergo degeneration also. If the serous or hemorrhagic fluid reabsorbs quickly, a well-demarcated area of atrophy of the pigment epithelium remains. [5]

When exudative SMD leads to fibrotic SMD, hemorrhage beneath the pigment epithelium and retina stimulates proliferation of fibrous tissue in these areas. If the hemorrhage fluid takes time to reabsorb, a disciform scar will develop. The retina overlying the disciform scar undergoes cystic degeneration and loss of its photoreceptor cell layer. [4]

As one can see, SMD can lead to reduced central vision. The onset of the vision loss may be due to the development of any of the previously mentioned types of SMD. The vision loss may be put into one of two categories: 1) image poorly resolved centrally; 2) central scotoma. [6]

In the first category, the fovea cannot resolve details at the usual viewing distance. Vision cannot be said to be truly blurred, since by moving closer or changing the amount of light entering the eye, a person can see normally with the parafoveal elements. There is no demonstrable scotoma on field tests or functionally. [6]

In the second category, there is decreased central acuity and a central

scotoma. The retinal function within the scotoma may not be uniformly depressed. A relative scotoma changes size with the intensity of the stimulus. An absolute scotoma is the same size regardless of the intensity of the stimulus. [6]

The SMD patient with a central defect must use some parafoveal or eccentric area of the retina. The nonfoveal retina cannot interpret details of objects with the clarity of the macula (see Table 1). The density and size of the scotoma determine how much the retinal image must be enlarged. The larger the scotoma, the larger the image must be to be interpreted by the remaining retinal elements. [7] The average SMD patient responds well to enlarged print, optical magnification, and high levels of illumination, particularly if the scotoma is small or of low density. [6]

Table 1 [6]

Visual acuity listed in radial degrees from fixation

Radius (degrees from fixation)	VA
1.0-2.5	20/20-20/40
2.5-5.0	20/40-20/60
5.0-7.5	20/60-20/80
7.5-10	20/80-20/100
10-20	20/100-20/200
20-30	20/400
30-60	8/200-4/200
60-80	3/200-1/200

The tendency of SMD to sooner or later become bilateral makes it a disabling condition, since the central area of the patient's field of vision is progressively affected so that reading, recognition of faces, driving, and many other daily activities gradually become impossible. [8]

The disease will not spread much beyond the very central portion of the patient's field of vision. Thus, with a functioning periphery and with the help of low vision aids, the patient may be able to perform some of the daily activities

he/she is used to. [8]

The following case study was designed to look at the clinical side of the SMD patient. It is hoped that it will give the clinician ideas on how to more efficiently care for the SMD patient.

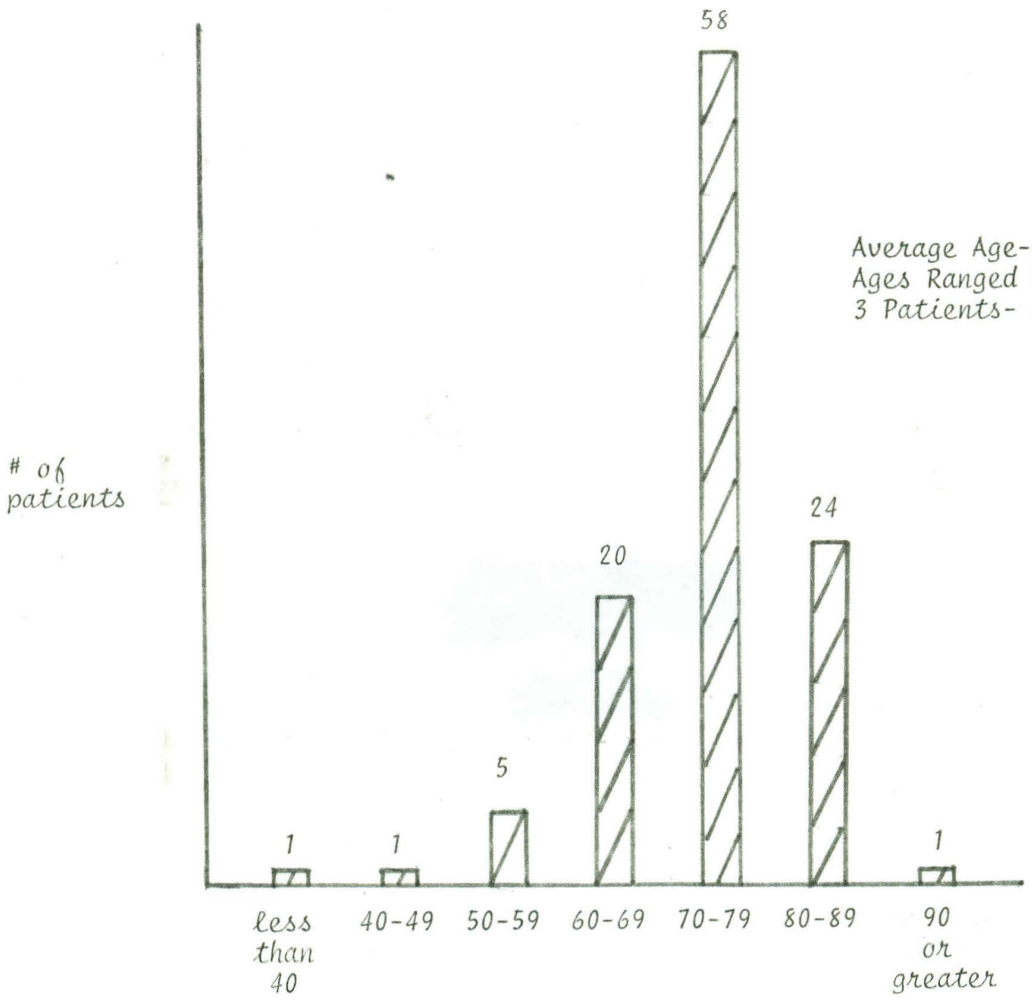
METHOD

The files of 113 SMD patients seen in the Ferris State Optometry Clinic in the years 1978-1982 were pulled from the records. The following data were selected from each of the files (if available):

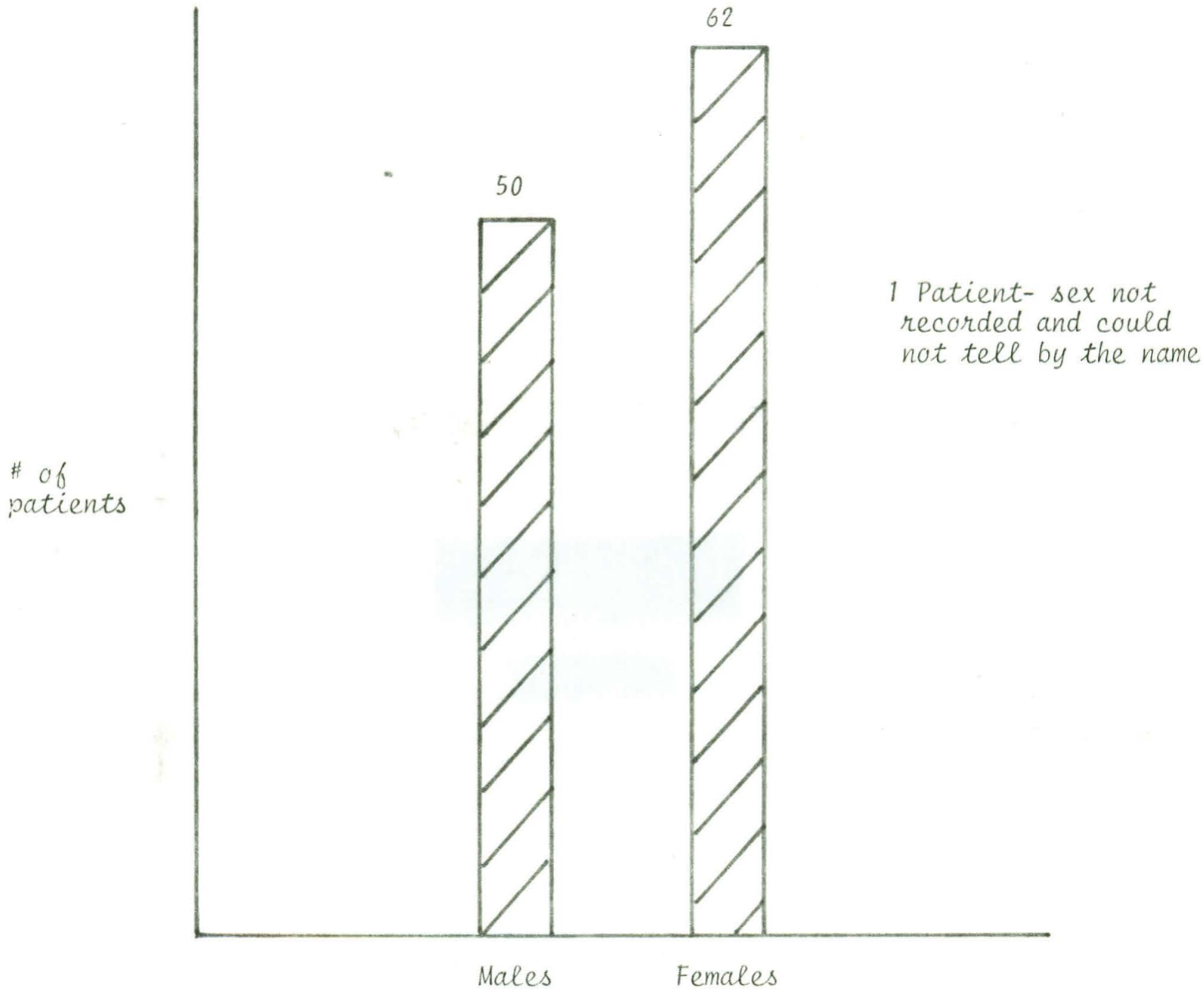
1) Age
2) Sex
3) Habitual Distance Visual Acuity O.D., O.S., O.U.- through conventional spectacle lenses, contact lenses, or unaided
4) Habitual Near Visual Acuity O.D., O.S., O.U.- through conventional spectacle lenses, contact lenses, or unaided
5) Best Distance Visual Acuity (BVA) O.D., O.S.
6) Patient's Subjective Assessment of Best Eye
7) SMD Type O.D., O.S.- non-exudative, exudative, atrophic, or fibrotic
8) Patient's Distance Needs- driving or general (mobility, sighting, television, etc.)
9) Patient's Near Needs- reading or general (knitting, carpentry, etc.)
10) Visual Field Testing- target size and scotoma size (smallest diameter); Autoplot, Arc Perimeter, Topcon, or Tangent Screen
11) Distance Aids Prescribed- magnification, visual acuity through the aid, and which eye prescribed for; telescope or updated distance spectacle Rx
12) Near Aids Prescribed- magnification, visual acuity through the aid, and which eye prescribed for; near aids broken down into five categories:
    a) Spectacle Plane Aids- reading Rx, bifocal Rx, loupes, had to be 20 diopters or less
    b) Stand Magnifiers
    c) Illuminated Magnifiers- stand or hand-held
    d) Hand-held Magnifiers
    e) Microscopes- all Feinbloom near aids and spectacle plane aids greater than 20 diopters
13) Clinic Patient Seen In- Low Vision or Other

The above data were analyzed and interesting distributions, correlations, and trends were studied.

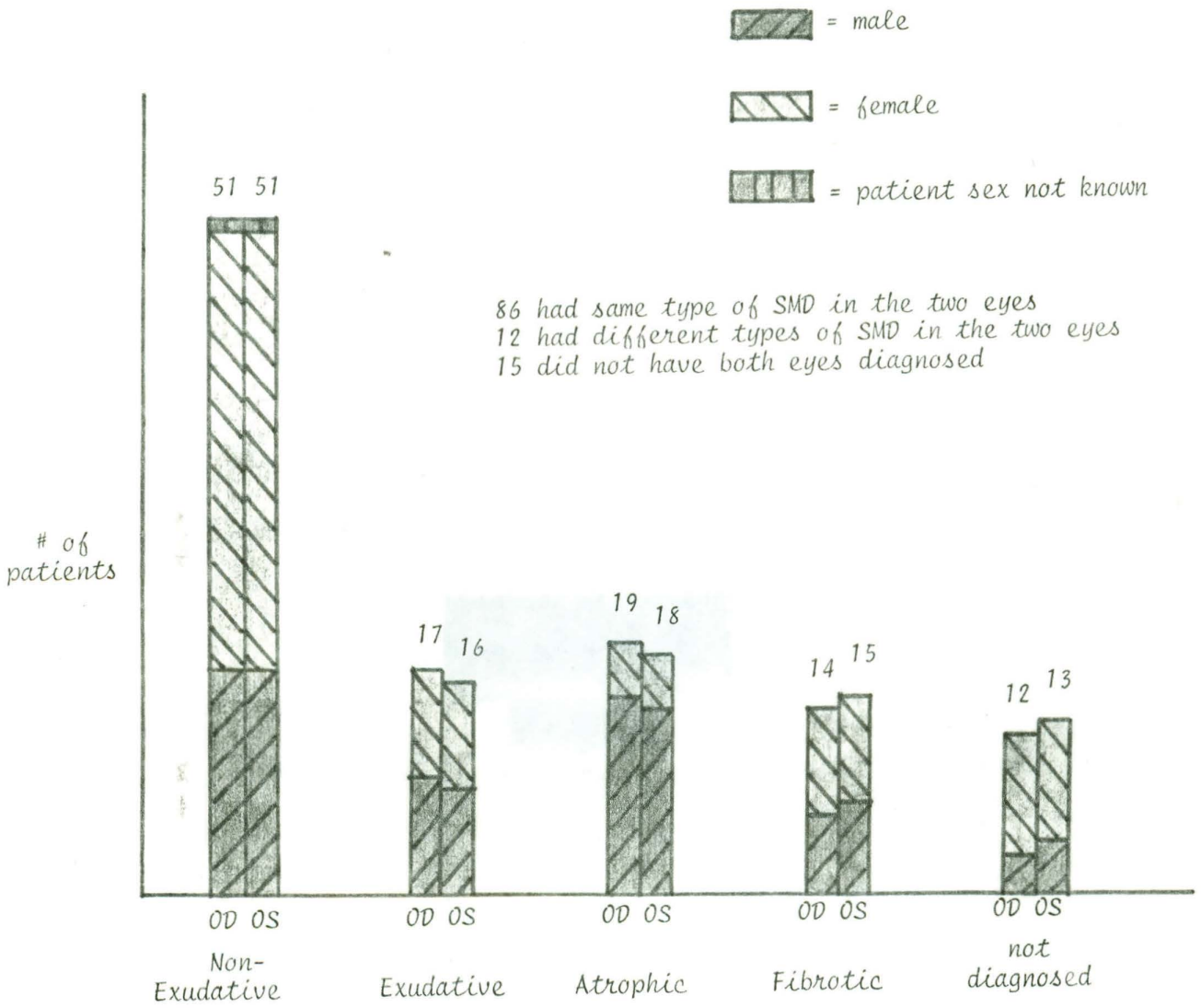
RESULTS



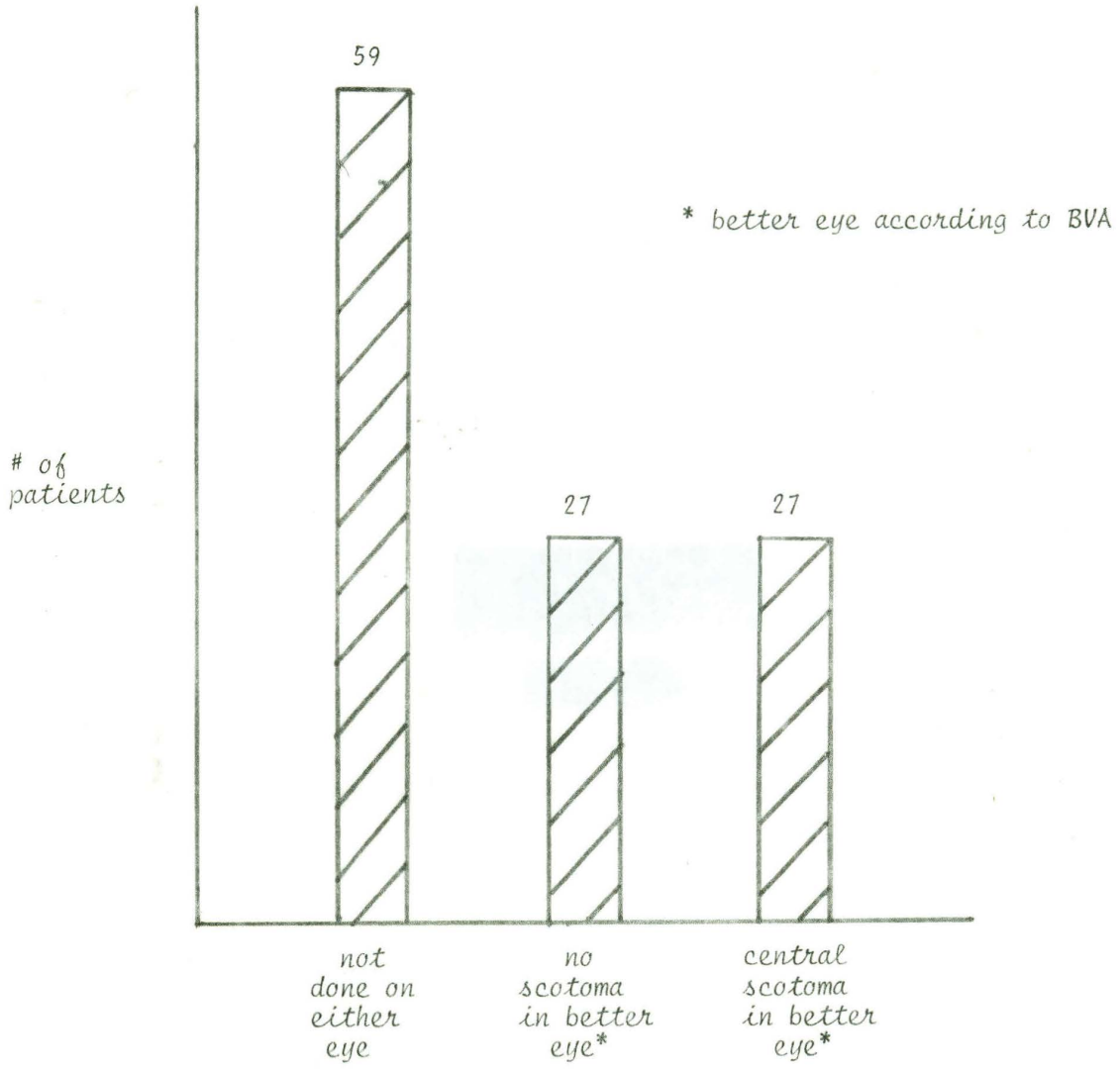
Graph 1- Age Distribution



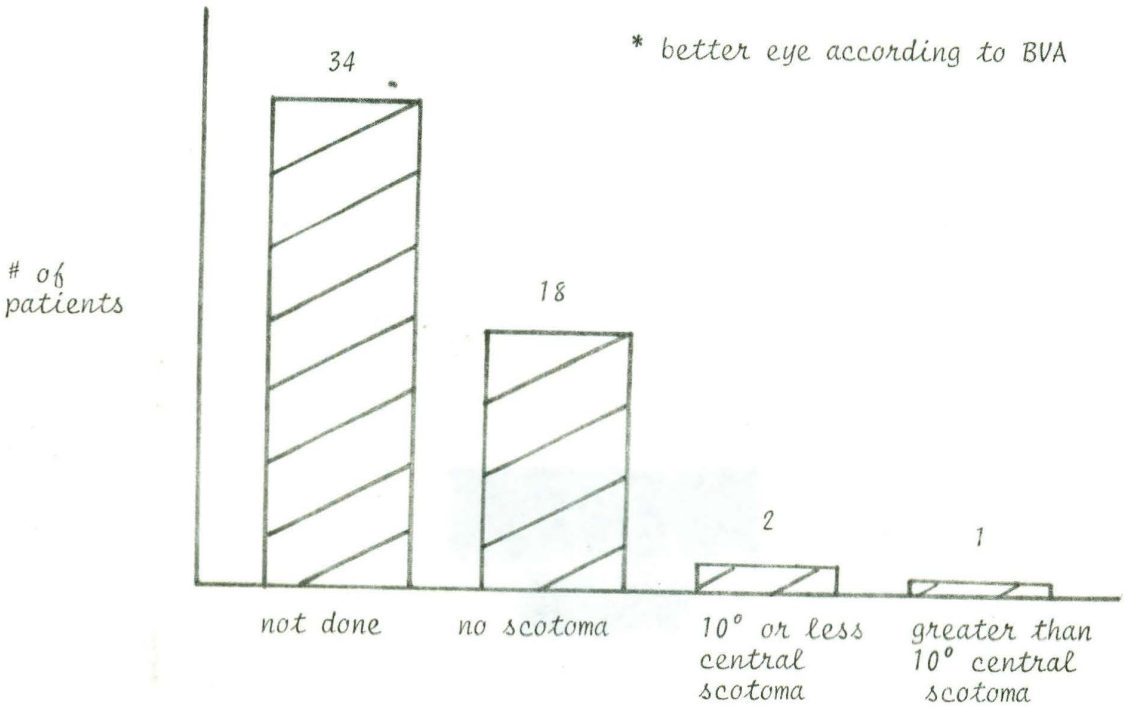
Graph 2- Sex Distibution



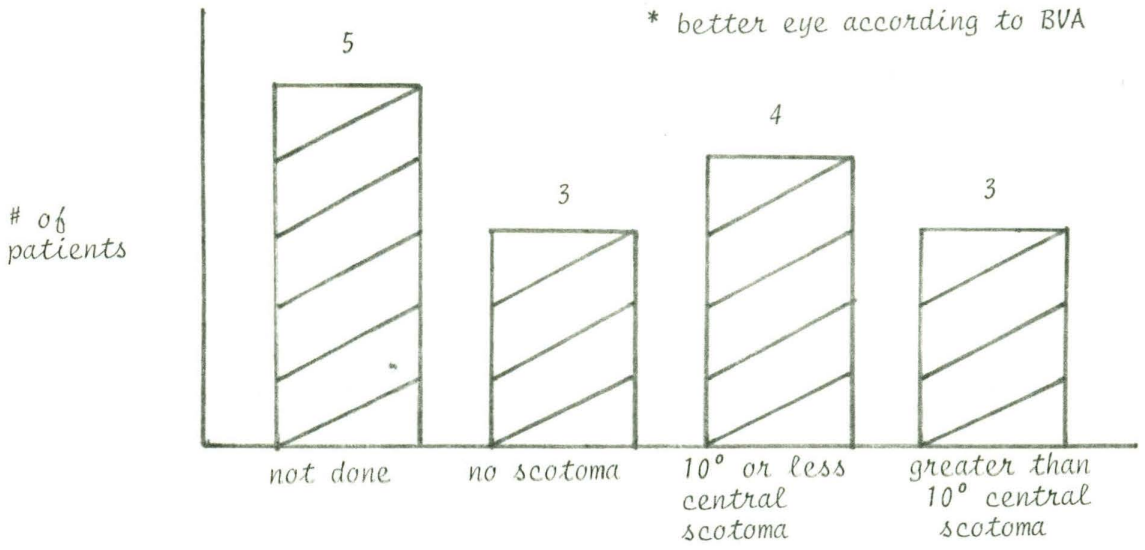
Graph 3- SMD Type Distribution



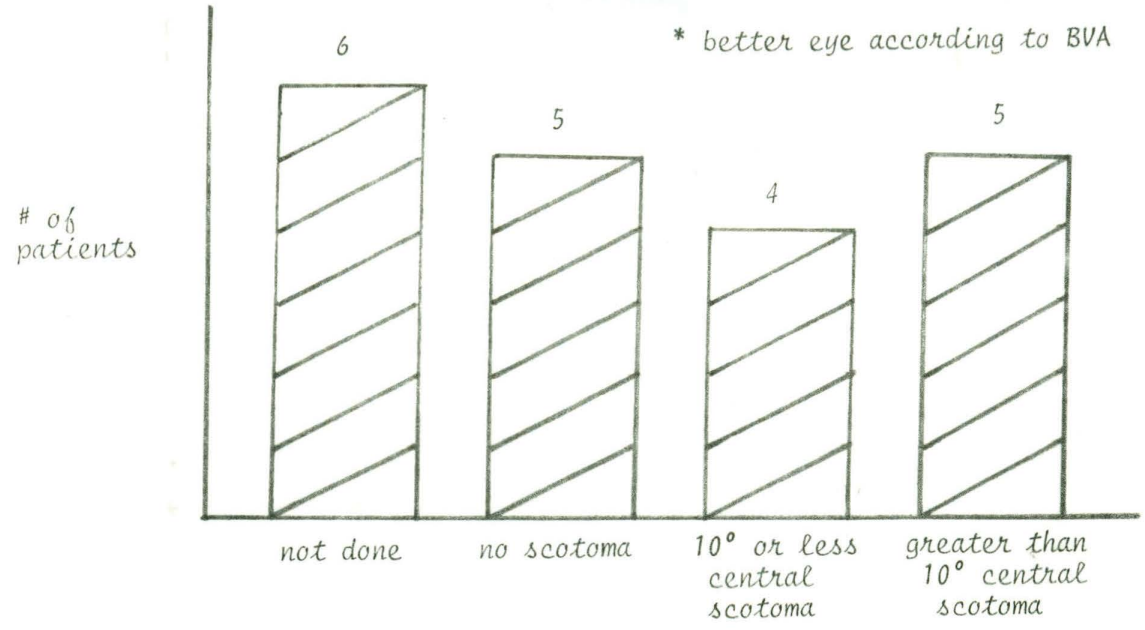
Graph 4- Visual Field Testing



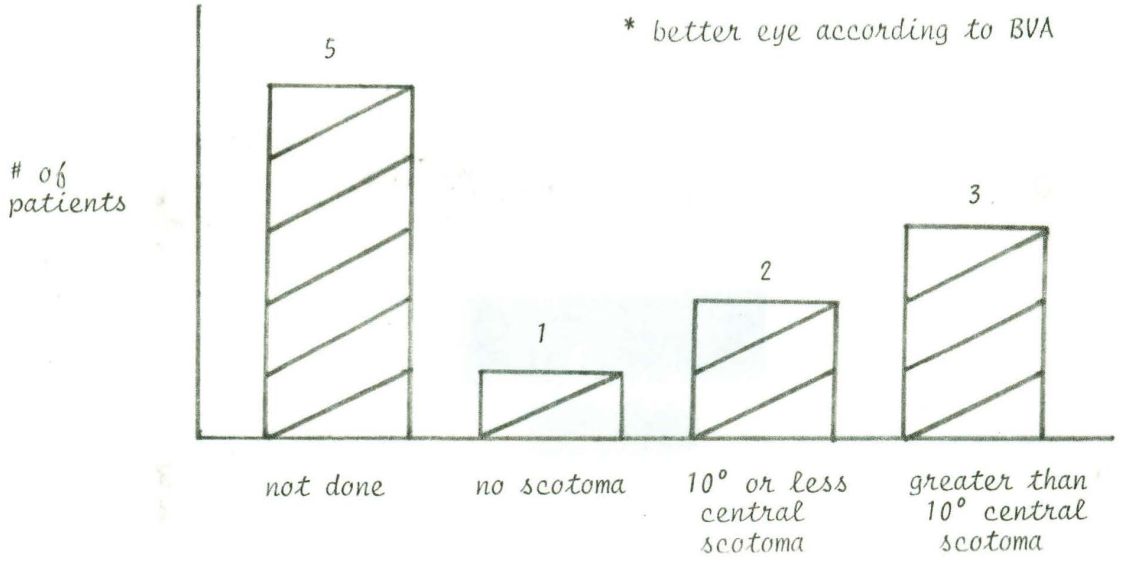
Graph 5- Non-Exudative SMD* vs. Visual Fields



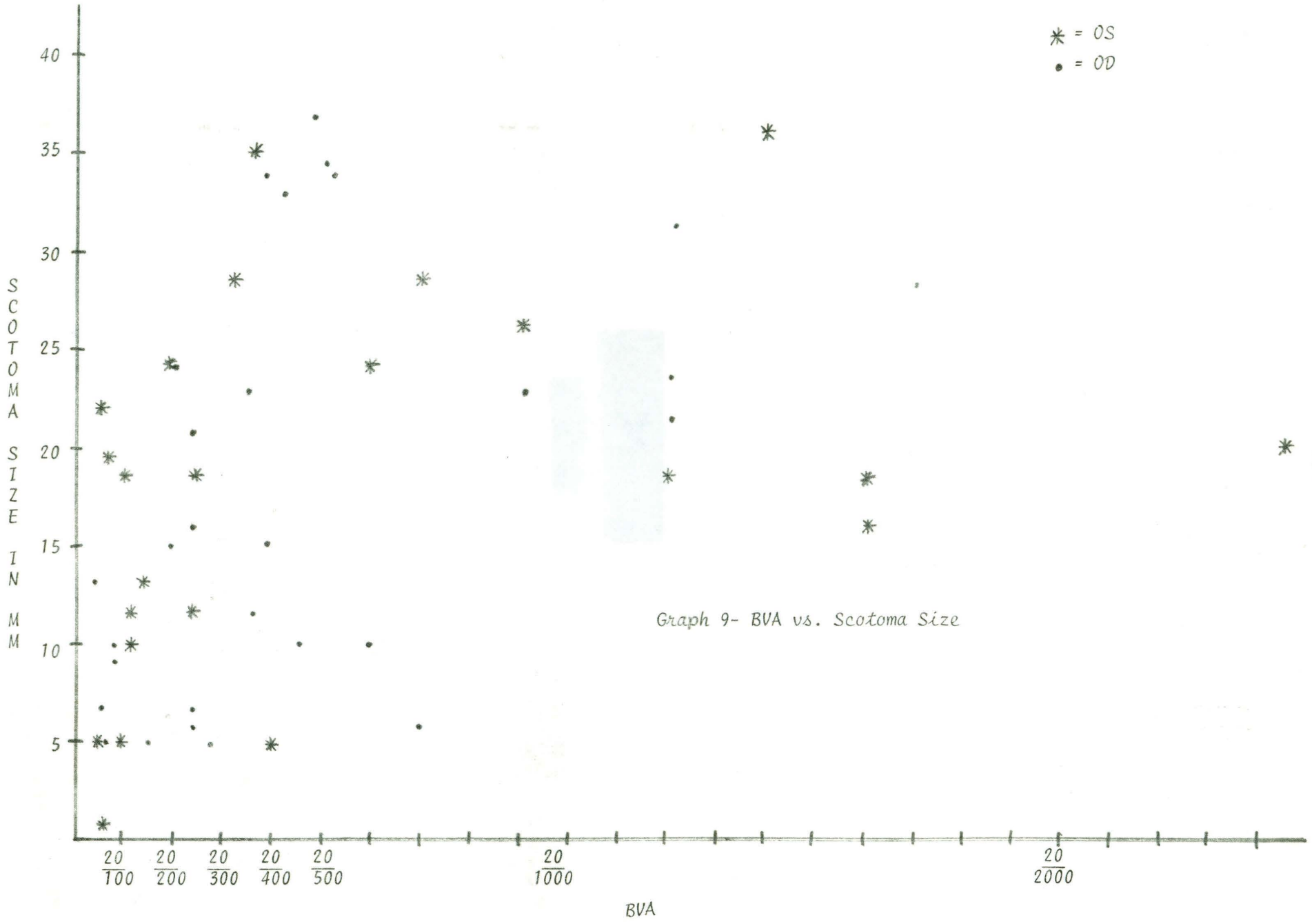
Graph 6- Exudative SMD* vs. Visual Fields



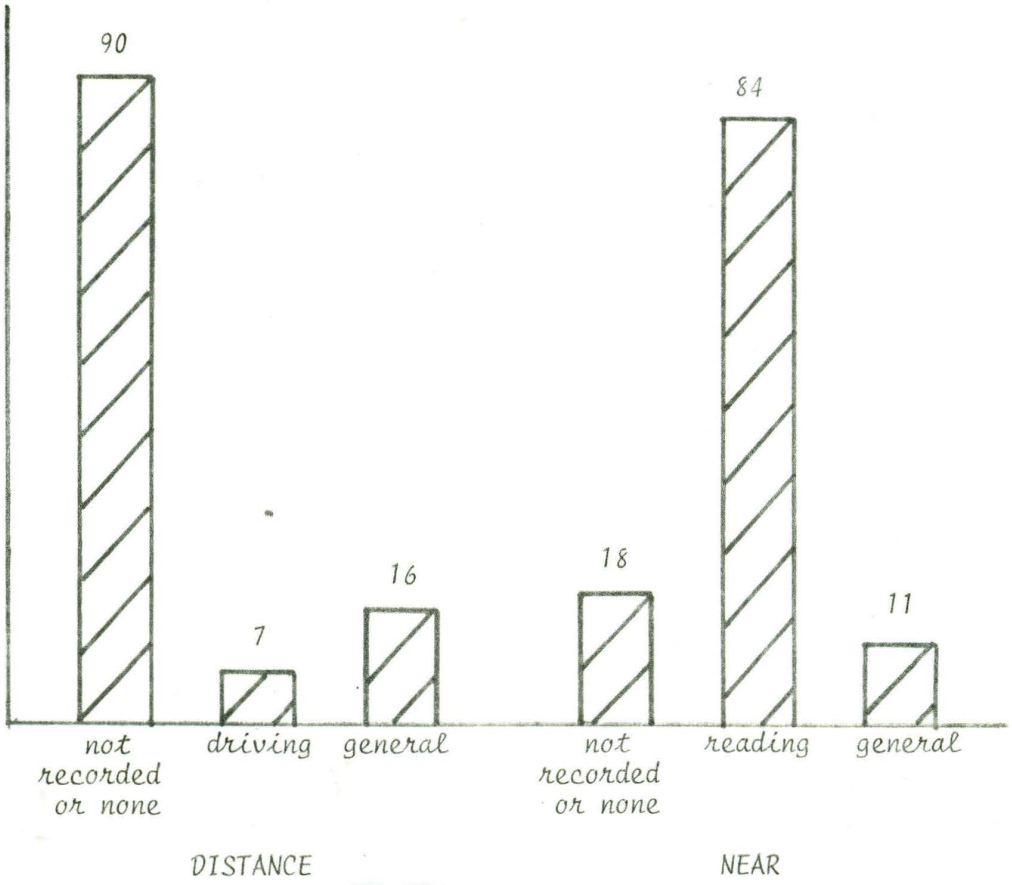
Graph 7- Atrophic SMD* vs. Visual Fields



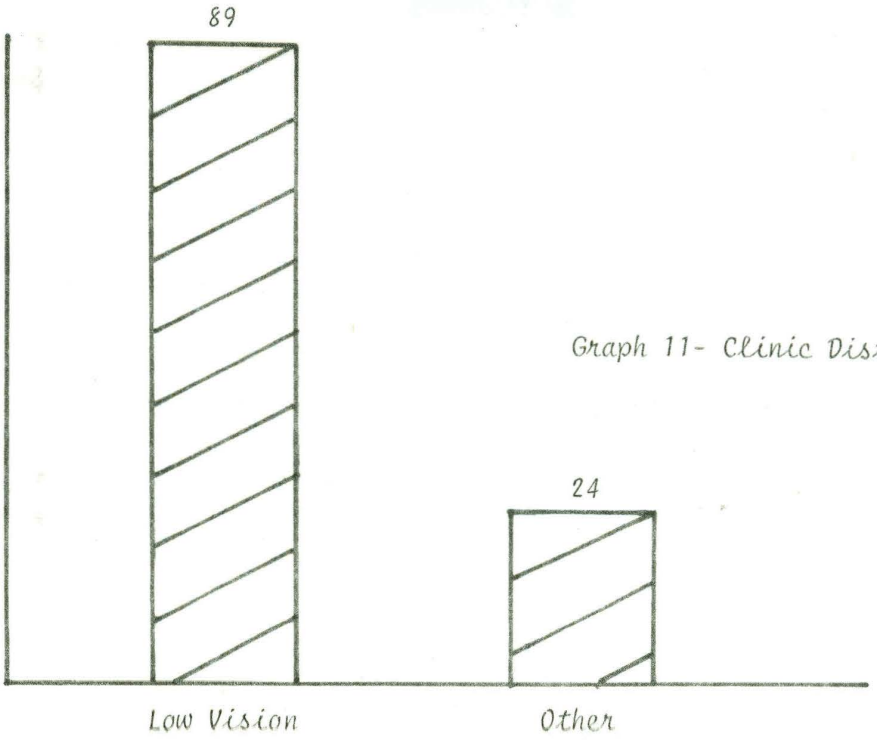
Graph 8- Fibrotic SMD* vs. Visual Fields



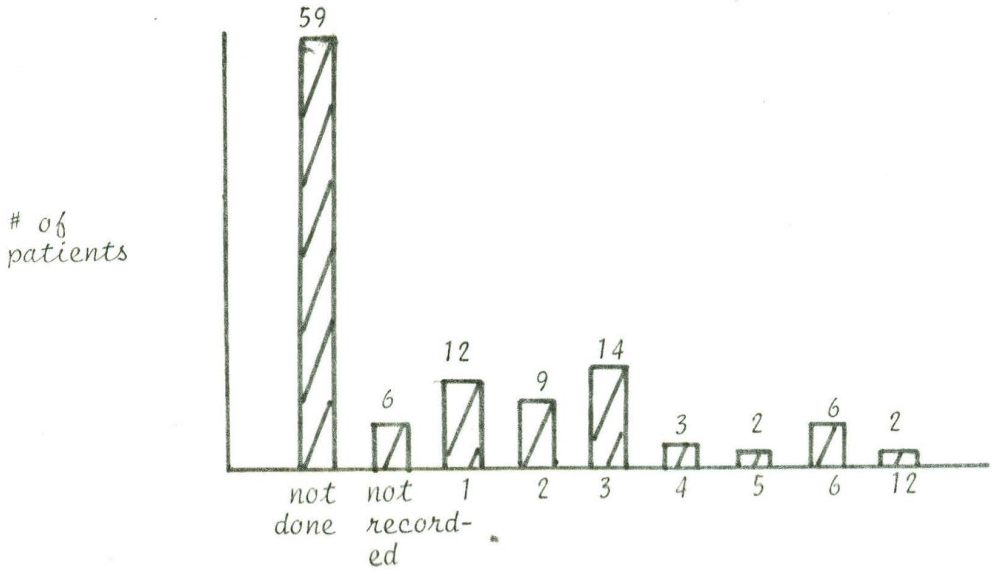
Graph 9- BVA vs. Scotoma Size



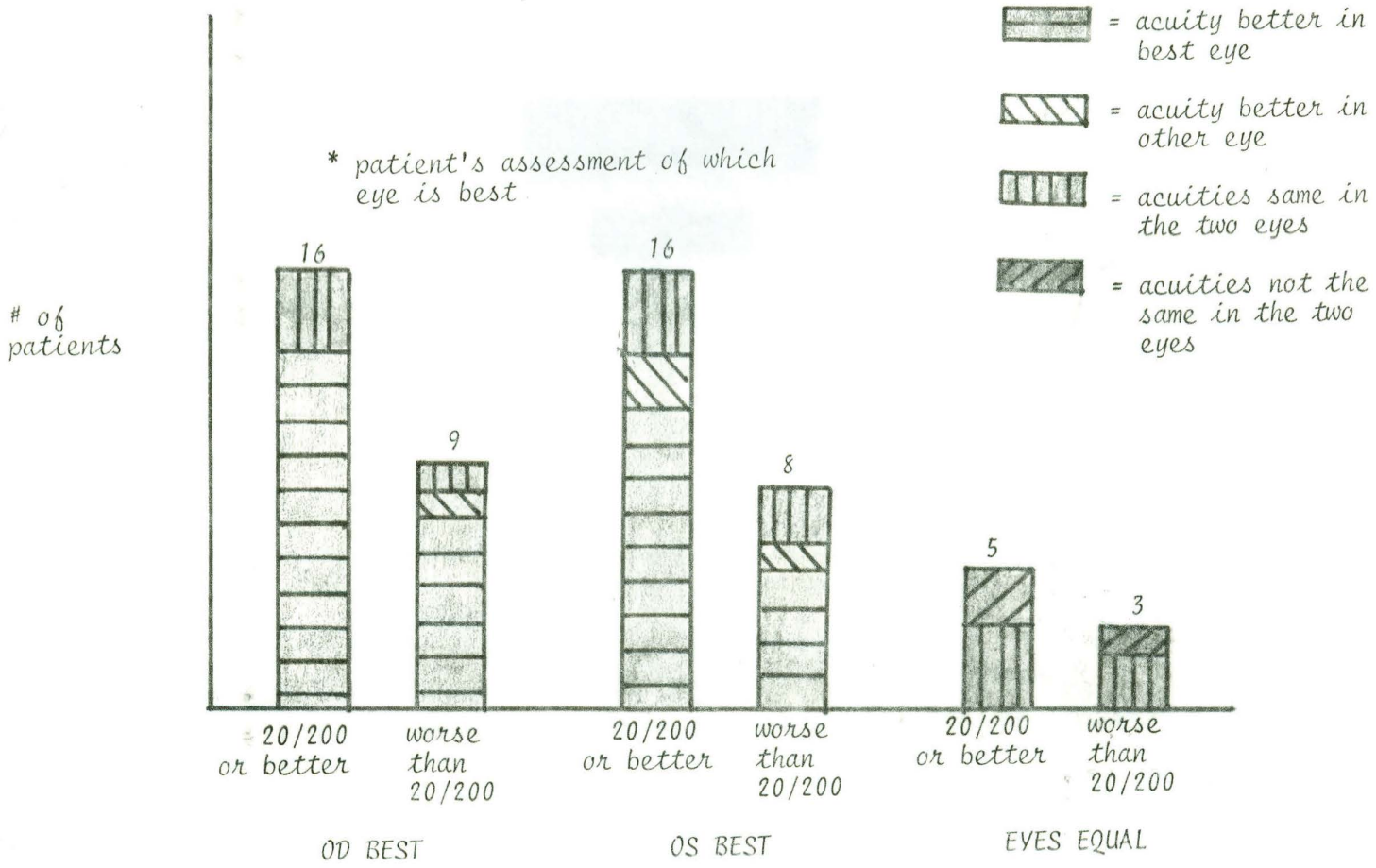
Graph 10- Patient Needs



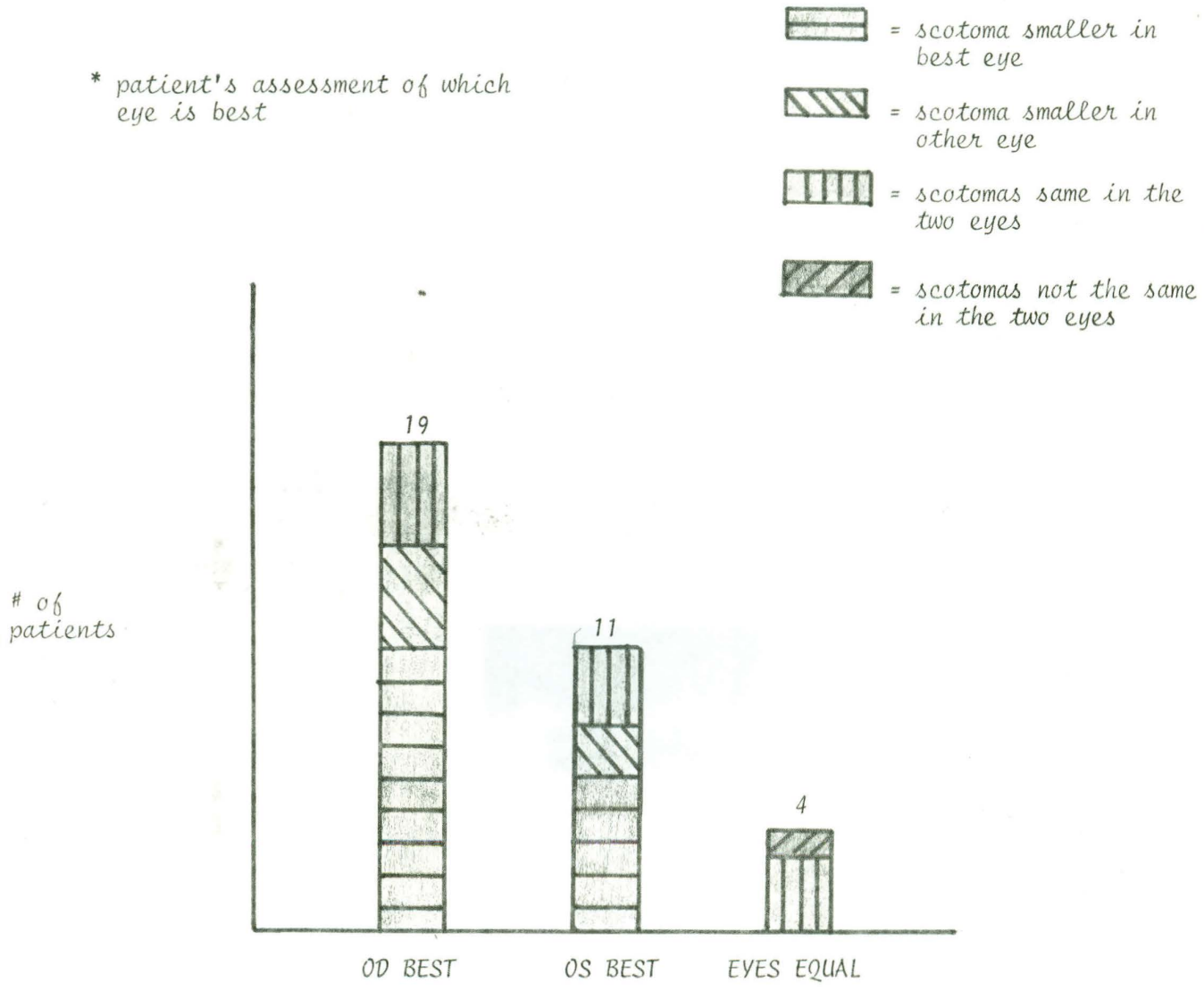
Graph 11- Clinic Distribution



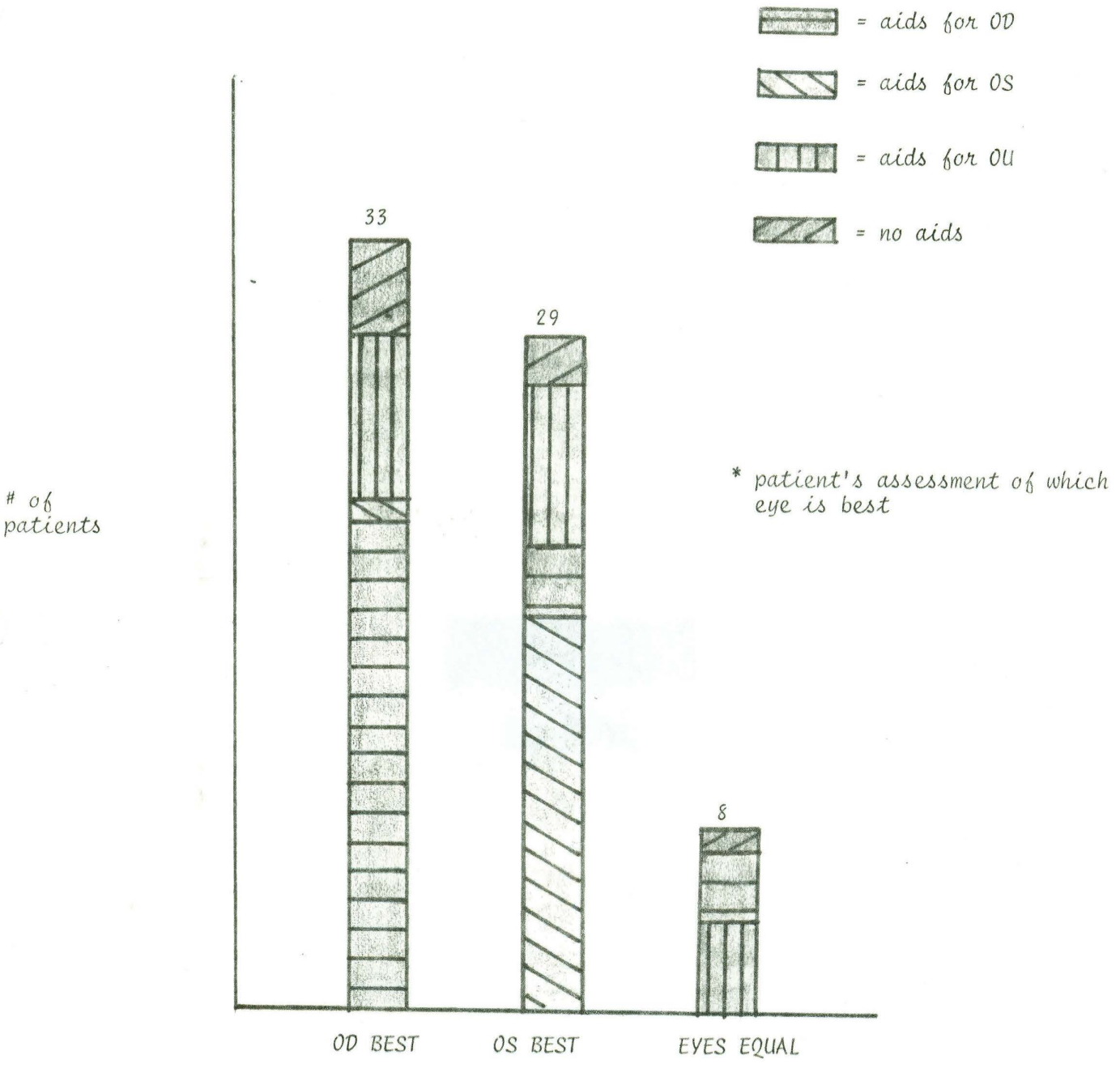
Graph 12- Visual Field Target Size (mm)



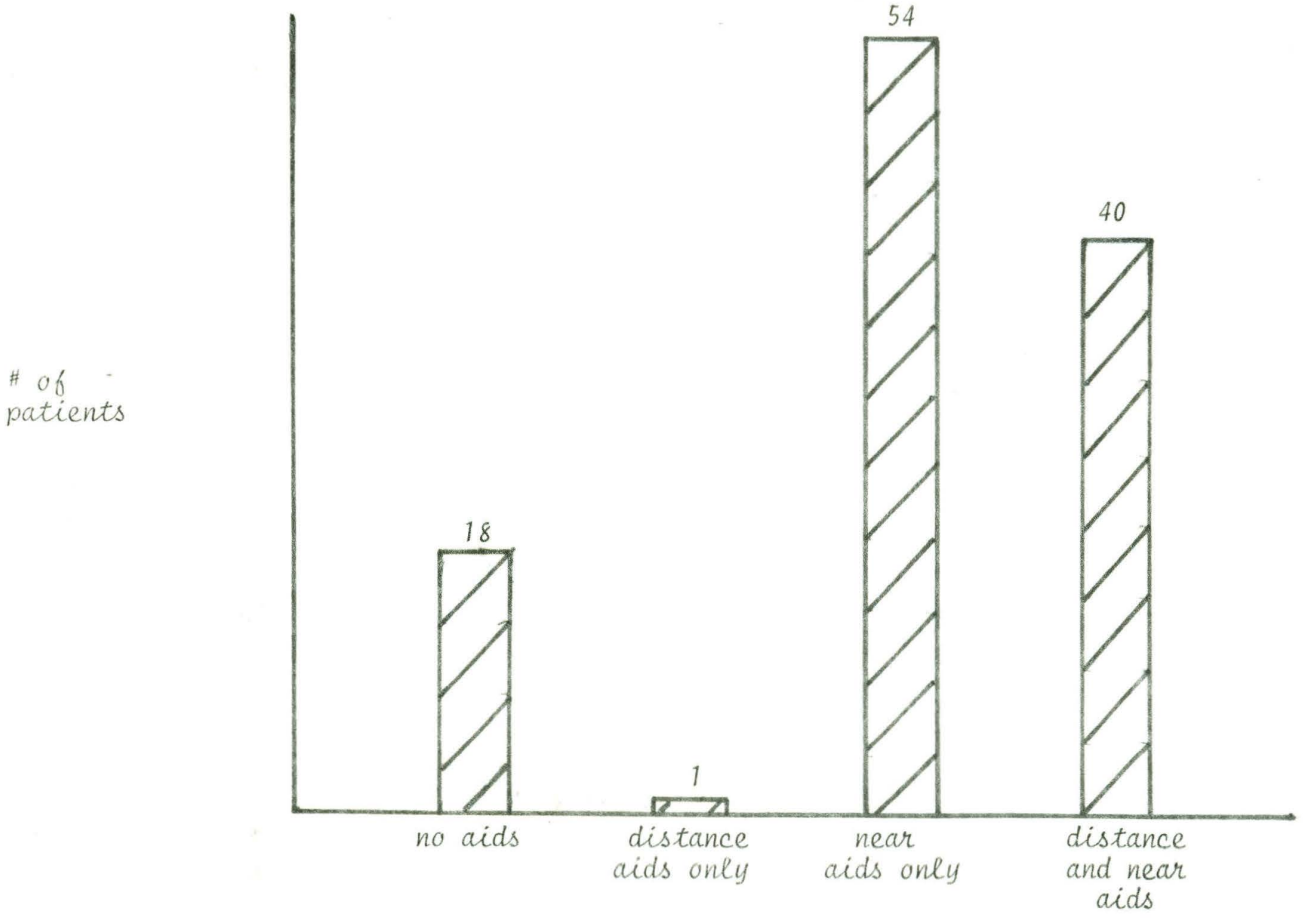
Graph 13- Best Eye* vs. BVA



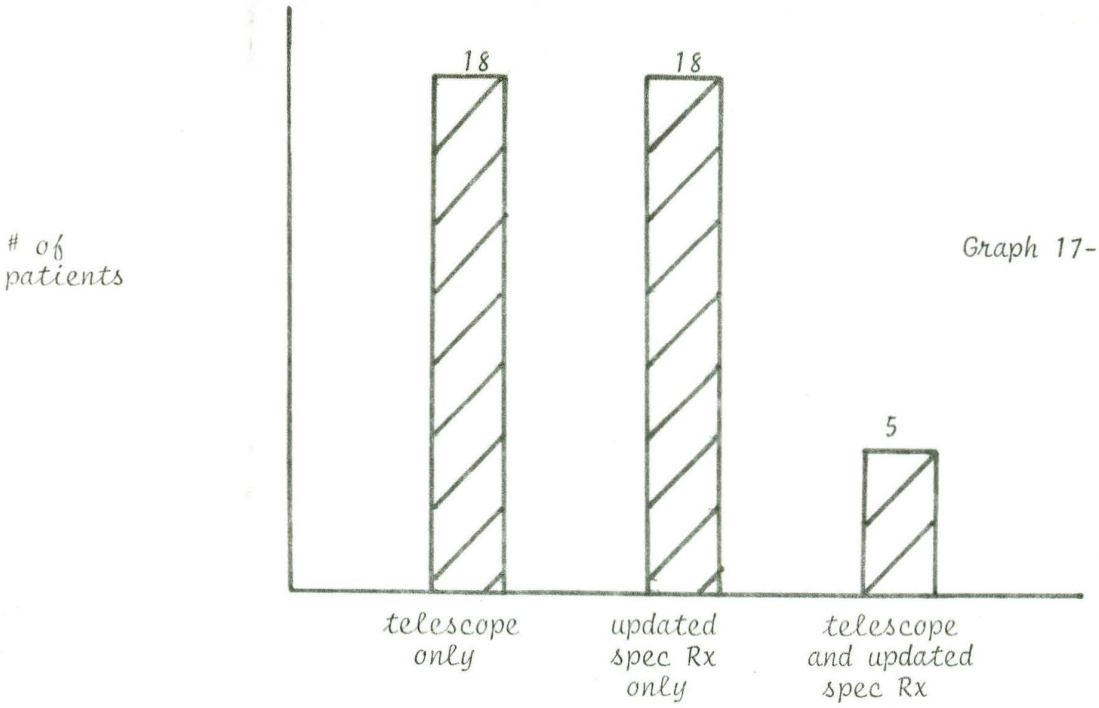
Graph 14- Best Eye* vs. Central Scotoma



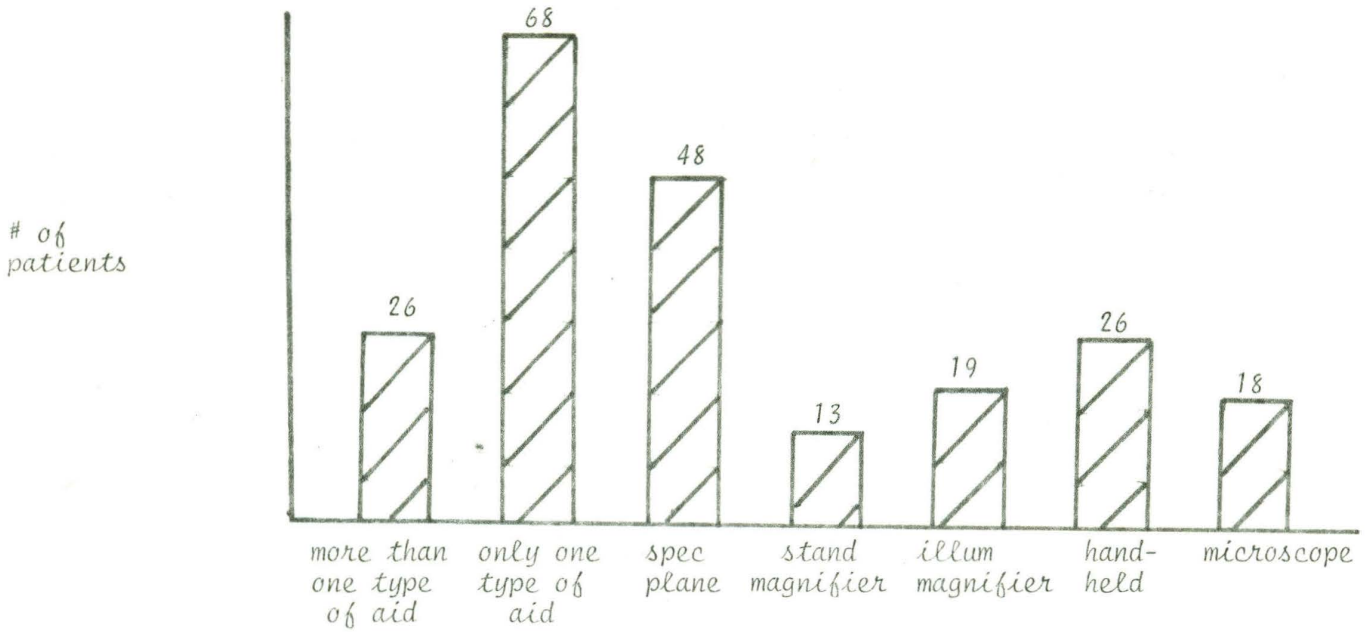
Graph 15- Best Eye* vs. Eye Aids Prescribed For



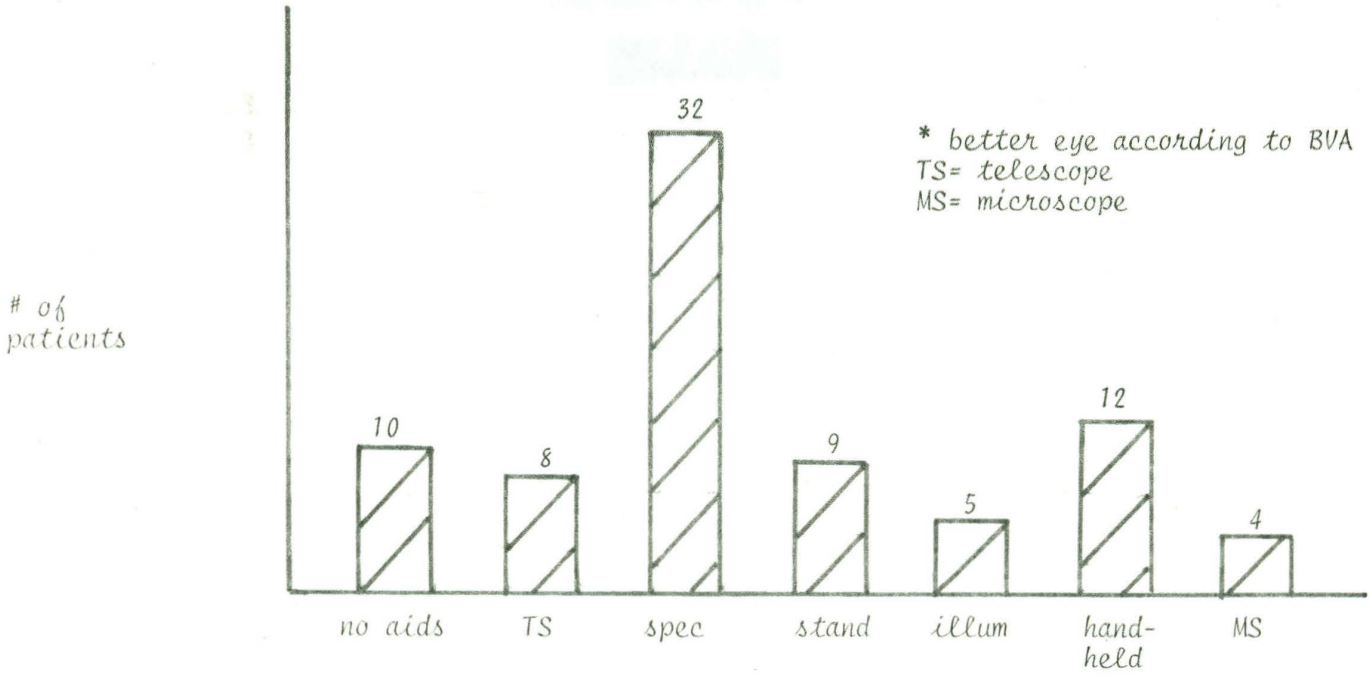
Graph 16- Aid Distribution (Near vs. Distance)



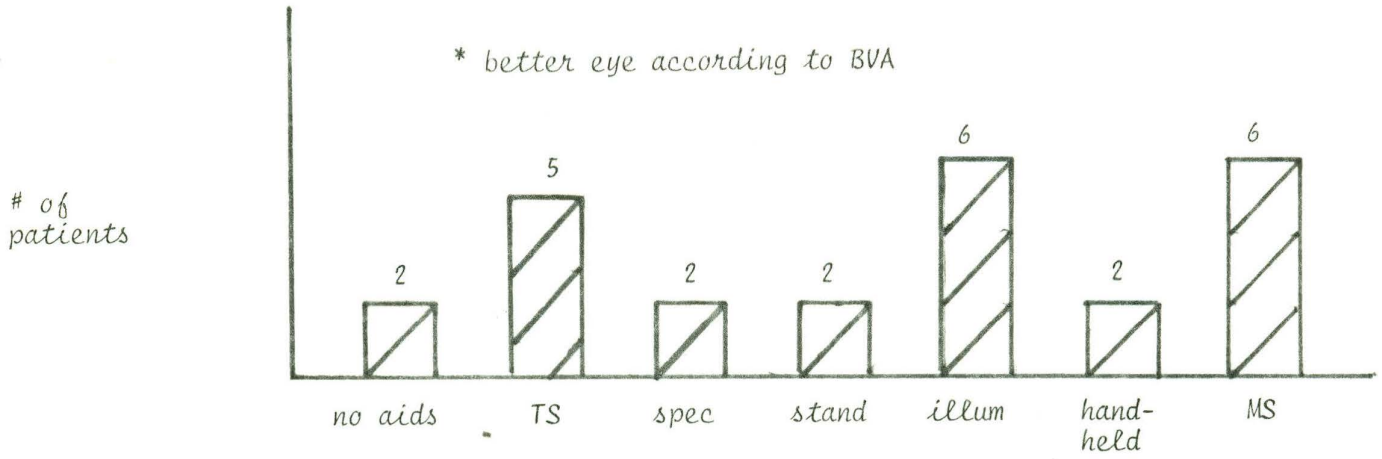
Graph 17- Distribution of Distance Aids



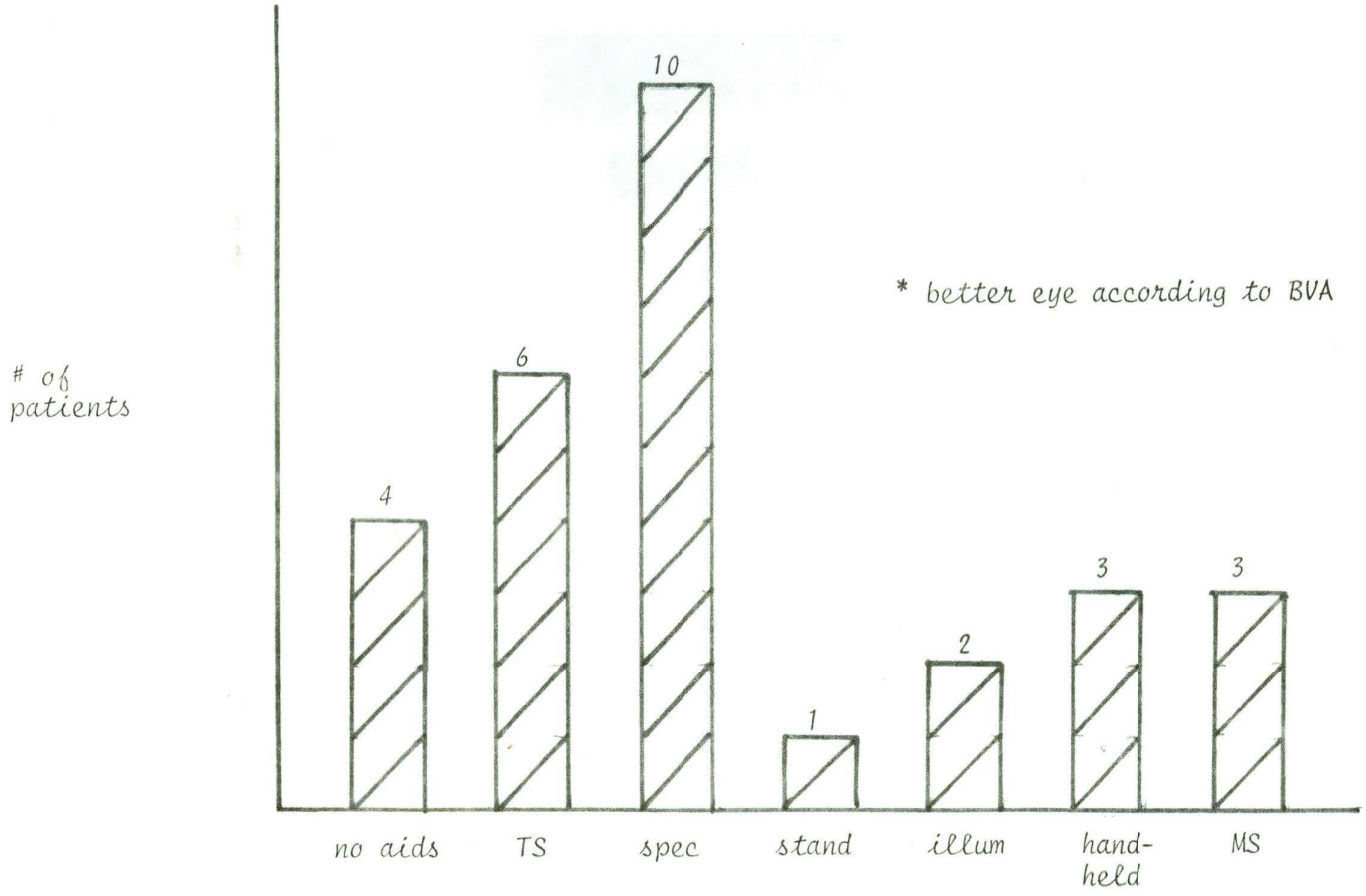
Graph 18- Distribution of Near Aids



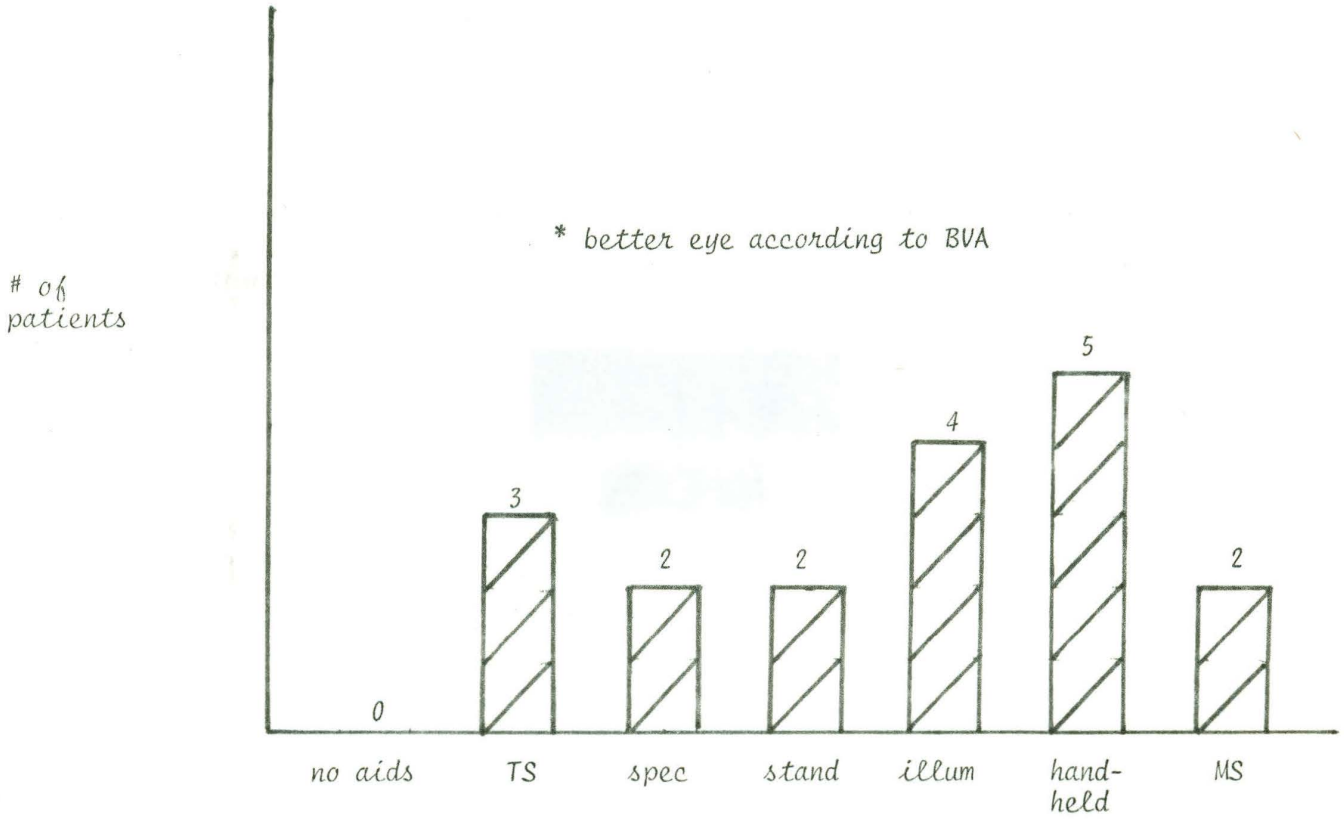
Graph 19- Non-Exudative SMD* vs. Aids



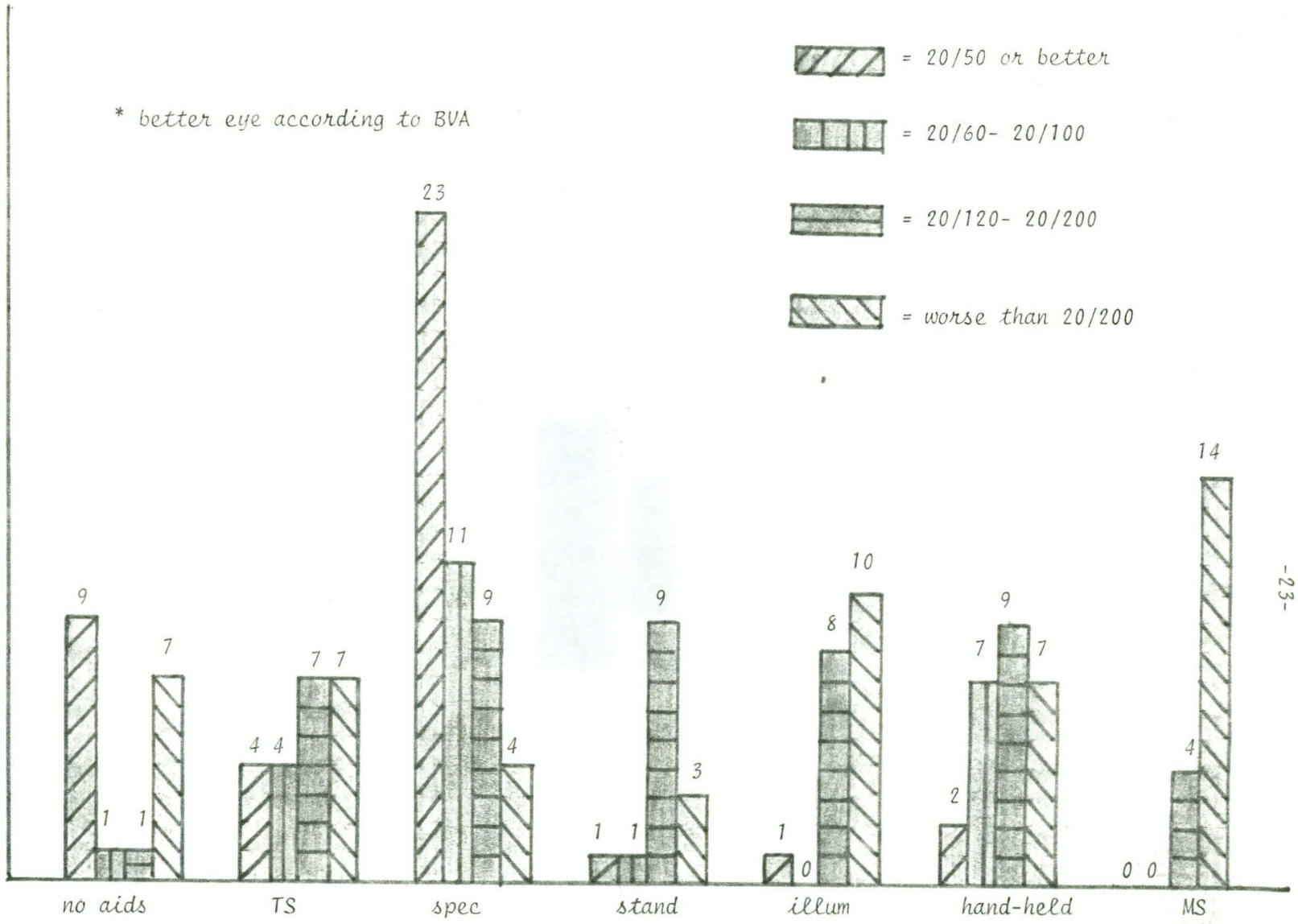
Graph 20- Exudative SMD* vs. Aids



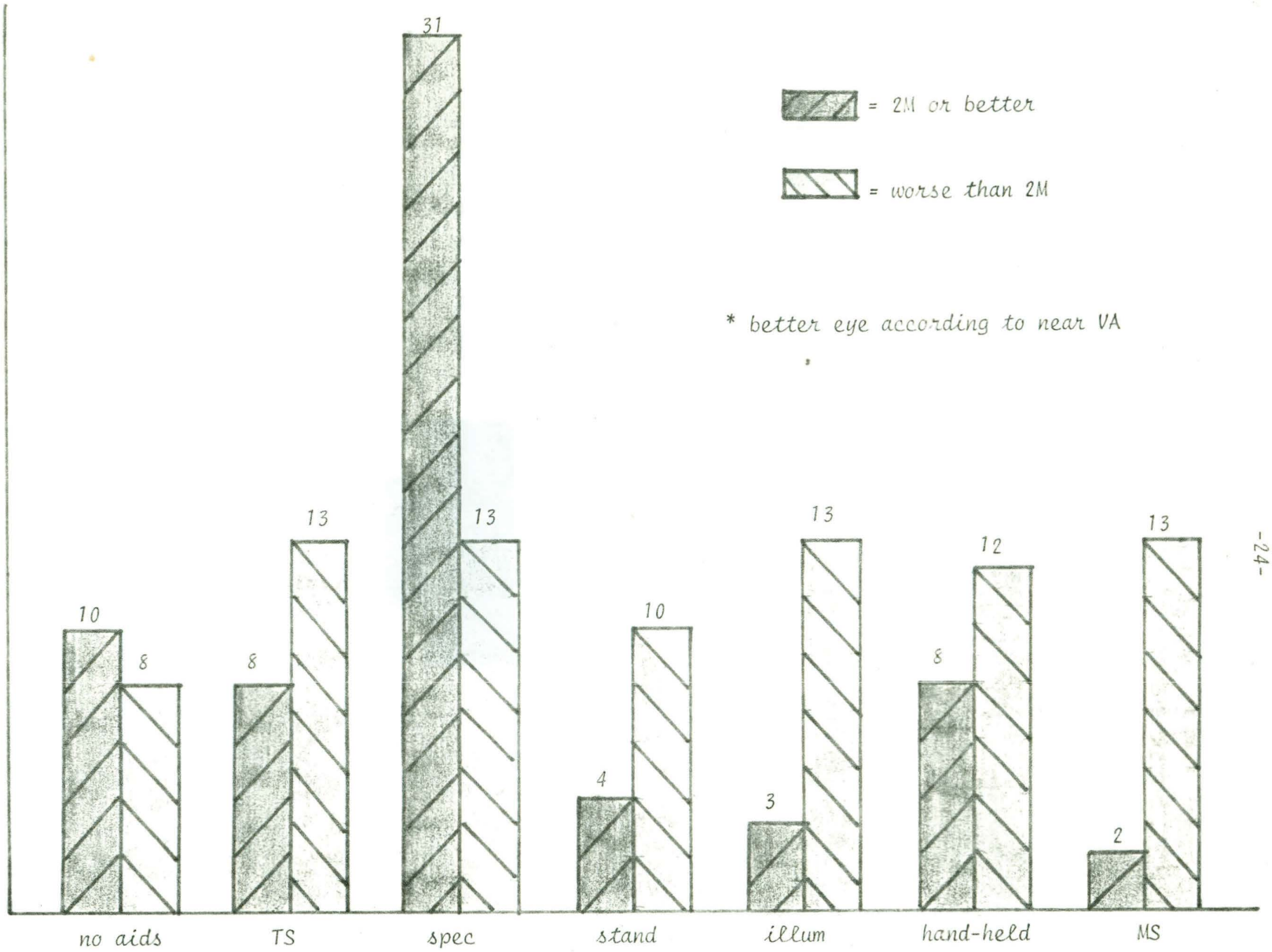
Graph 21- Atrophic SMD* vs. Aids



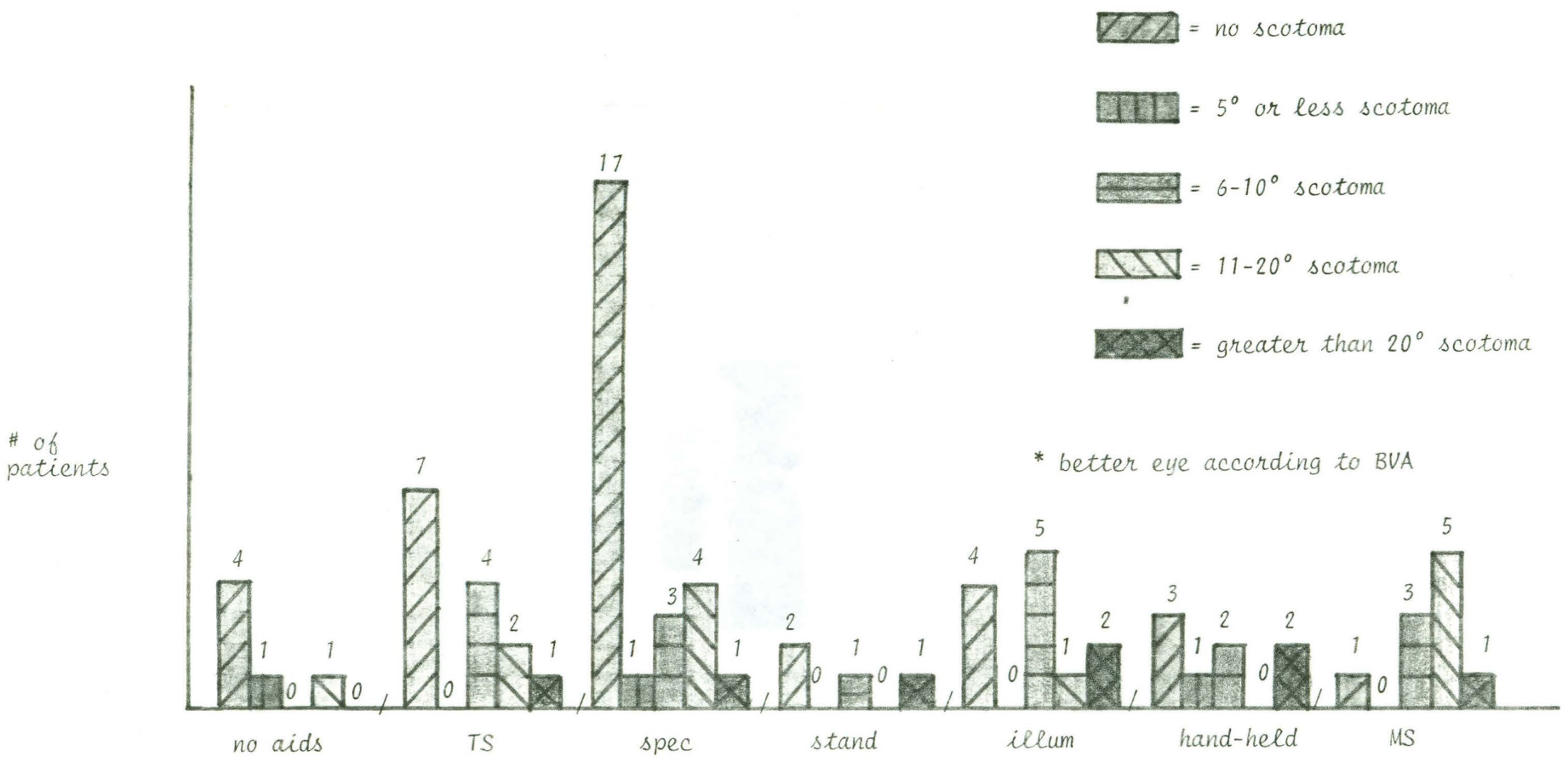
Graph 22- Fibrotic SMD* vs. Aids



Graph 23- BVA* vs. Aids



Graph 24- Near Habitual VA* vs. Aids



Graph 25- Scotoma Size* vs. Aids

DISCUSSION

Age Distribution (Graph 1)- 52.7% of the total patient population fell in the 70-79 year-old group, while the second largest group was the 80-89 year-old group. This shows that SMD is indeed related to aging changes and the prevalence of SMD increases with age.

Sex Distribution (Graph 2)- 55.4% of the total patient population were females; 44.6% males.

SMD Type Distribution (Graph 3)- 45.1% of the total patient population had non-exudative SMD, while the other three types were quite evenly distributed. More females had non-exudative SMD by 1.9 to 1; more males had atrophic SMD by 3.6 to 1. 87.8% of the total patient population had the same type of SMD in the two eyes. This supports the tendency of SMD to sooner or later become bilateral. Hopefully, the high percentage of non-exudative SMD means that many of the cases are not progressing to the more serious stages of the disease.

Visual Field Testing (Graph 4)- 52.2% of the total patient population did not have fields done on either eye. Two possible reasons for this are as follows: 1) It is not considered an important test in the care of the patient, as the clinician can usually tell if there is a central scotoma by whether the patient eccentrically views or not; 2) It is very difficult to do fields on the SMD patient, who is older and often does not have good fixation. A possible reason for doing visual fields more in the future is as a training tool for eccentric viewing.

* It must be pointed out to the reader that on those patients who did have fields done, usually only one isopter was tested and various target sizes were used. It was impossible, therefore, to tell if there was an absolute or a relative scotoma.

Non-Exudative SMD vs. Visual Fields (Graph 5)- 85.7% of the patients with

non-exudative SMD who had fields done showed no central scotoma. This fits in well with the vision loss category of image poorly resolved.

Exudative SMD vs. Visual Fields (Graph 6)- 70.0% of the patients with exudative SMD who had fields done showed a central scotoma. This probably corresponds to the area of the serous and/or hemorrhagic detachment.

Atrophic SMD vs. Visual Fields (Graph 7)- 64.3% of the patients with atrophic SMD who had fields done showed a central scotoma. One would expect an area of atrophy to exhibit a central scotoma.

Fibrotic SMD vs. Visual Fields (Graph 8)- 83.3% of the patients with fibrotic SMD who had fields done showed a central scotoma. One would expect a fibrotic area to exhibit an absolute central scotoma.

BVA vs. Scotoma Size (Graph 9)- As one can see, there does not seem to be much of a correlation here. This may be related to the fact that visual field testing was done in such a way that one cannot distinguish a relative from an absolute scotoma.

Patient Needs (Graph 10)- 79.6% of the total patient population had no distance needs, while 74.3% listed reading as their primary near need. This corresponds well with the fact that the SMD patient is older, usually retired, and leads a more casual lifestyle. The patient is not interested in driving anymore, especially since the vision is reduced and there is a fear of causing an accident. The patient would rather be in more familiar surroundings, content with reading as a primary activity.

Clinic Distribution (Graph 11)- 78.8% of the patients were seen in the Low Vision Clinic. This relates to the fact that the SMD patient needs specialty care in dealing with the reduction in or loss of central vision.

Visual Field Target Size (Graph 12)- 25.9% of those that had fields done were tested with a 3mm target; it was the most prevalent target size.

Best Eye vs. BVA (Graph 13)- 71.9% of those patients in which a comparison was possible chose the best eye to be the one with better visual acuity or chose the eyes equal when the acuities in the two eyes were equal. The comparison was the same in the two acuity groups. One would expect the patients to choose the eye with the better acuity as the best eye.

Best Eye vs. Central Scotoma (Graph 14)- 58.8% of those patients in which a comparison was possible chose the best eye to be the one with the smaller central scotoma or chose the eyes equal when the scotomas in the two eyes were the same size. This shows that the SMD patient is sensitive to the presence of a central scotoma; that the patients preferred the eye with the smaller defect relates to the decrease in visual acuity as the amount of retinal eccentricity increases (see Table 1).

Best Eye vs. Eye Aids Prescribed For (Graph 15)- 60.0% of those in which a comparison was possible had the aids prescribed for the eye they chose as best or had the aids prescribed for both eyes when they chose the eyes equal. In the majority of cases, then, the clinician ends up prescribing an aid for the eye(s) that the patient subjectively chooses as best.

Aid Distribution- Near vs. Distance (Graph 16)- 84.1% of the patients were prescribed aids; 36.3% were prescribed distance aids; 83.2% were prescribed near aids. As one can see, most SMD patients can be helped by low vision aids. One would expect from the patient needs (see Graph 10) that if a patient could be helped, it would be with near aids as the majority of patients wanted to be able to read. More distance aids were prescribed than one might expect from the

number of patients with distance needs. So, even if the SMD patient does not state any distance need, he/she may still be able to benefit from a distance aid.

Distribution of Distance Aids (Graph 17)- 20.4% of the patients were prescribed a telescope; 20.4% were prescribed an updated distance spectacle Rx. This shows that it is important to check the refraction of the SMD patient, as just an updated Rx may help. It also shows the importance of testing the benefit of a telescope for the patient.

Distribution of Near Aids (Graph 18)- 42.5% of the patients were prescribed spectacle plane aids; 11.5% stand magnifiers; 16.8% illuminated magnifiers; 23.0% hand-held magnifiers; 15.9% microscopic aids. This shows the preference of the SMD patient for near aids in the spectacle plane, which have the advantage of a large field of view and leave both hands free to hold reading material.

Non-Exudative SMD vs. Aids (Graph 19)- 58.2% of the non-exudative SMD patients were prescribed an aid in the spectacle plane. This shows the preference of the non-exudative patient for the large field of view.

Exudative SMD vs. Aids (Graph 20)- 40.0% of the exudative SMD patients were prescribed illuminated magnifiers; 40.0% microscopic aids. It is possible that those who chose the illuminated magnifiers needed more magnification (because of central scotoma associated with the exudative type) but could not tolerate the close working distance of high-power spectacles. Those that were prescribed microscopes needed the increased magnification available in that type of aid.

Atrophic SMD vs. Aids (Graph 21)- 50.0% of the atrophic SMD patients were prescribed aids in the spectacle plane. These patients also seem to prefer the large field of view, but must be able to tolerate the closer working distance of the high-power spectacles.

Fibrotic SMD vs. Aids (Graph 22)- 45.5% of the fibrotic SMD patients were prescribed hand-held magnifiers; 36.4% illuminated magnifiers. This shows that the fibrotic SMD patients with large scotomas cannot obtain reading acuity even with high magnification, so they accept less magnification and the normal working distance.

BVA vs. Aids (Graph 23)- 69.7% of those patients with 20/50 or better acuity were prescribed spectacle plane aids; 68.8% of those with 20/60-20/100 were prescribed specs; for those with 20/120-20/200, 36.0% were prescribed spectacle plane aids, 36.0% stand magnifiers, 36.0% illuminated magnifiers, 28.0% telescopes; for those with less than 20/200, 37.8% were prescribed microscopic aids, 27.0% illuminated magnifiers. This shows that those SMD patients with 20/100 or better acuity prefer near aids in the spectacle plane- large amounts of magnification are not required and the working distance is not reduced a great deal. Those patients with 20/120-20/200 need greater amounts of magnification, and some begin to reject the reduced working distance of the high-power spectacles and go to the stand, hand-held, and illuminated aids. The 20/120-20/200 patients also benefit from telescopes, where the telescope can be of medium power and the field of view through it is not reduced a great deal. Those with less than 20/200 acuity need the largest amounts of magnification, and begin to choose microscopes as the best aid for them.

Near Habitual VA vs. Aids (Graph 24)- 63.3% of those with 2M or better were were prescribed spectacle plane aids; for those with less than 2M, 25.5% were prescribed specs, 25.5% illuminated aids, 25.5% microscopic aids, 25.5% hand-held aids. This shows the same thing as Graph 23 (BVA vs. Aids). As acuity worsens,

more magnification is required and as magnification increases, the patients begin to turn away from spectacle plane aids to the other types.

Scotoma Size vs. Aids (Graph 25)- 63.0% of those patients with no central scotoma were prescribed spectacle plane aids; for those with a 5° or less scotoma, 33.3% were prescribed specs, 33.3% hand-held aids; for those with a 6-10° scotoma, 50.0% were prescribed illuminated aids, 40.0% telescopes, 30.0% specs, 30.0% microscopes; for those with an 11-20° scotoma, 50.0% were prescribed microscopes, 40.0% specs; for those with a greater than 20° scotoma, 50.0% were prescribed illuminated aids, 50.0% hand-held aids. This shows a relationship between scotoma size and type of aid preferred by the SMD patient. As the scotoma size increases, more magnification is required (again related to decreased visual acuity at eccentric retinal points) and the patients begin to choose the other types of aids over the spectacle plane aids. As far as telescopes are concerned, the larger the scotoma, the less chance the patient will accept the telescope and its decreased field of view.

CONCLUSION

This paper has hopefully given the clinician some helpful clues on how to optically care for the SMD patient. Along with an understanding of the disease process, these predictions of what low vision aids most often satisfy patient needs will give the clinician a head start in caring for the SMD patient. This will be extremely important for most clinicians, as they will see many SMD patients in their practices as the older population continues to grow.