EVALUATING THE ACCURACY OF PREDICTED NEAR MAGNIFICATION COMPARED TO PATIENT SELECTED DEVICES IN VISION REHABILITATION PATIENTS WITH A PRIMARY DIAGNOSIS OF AGE RELATED MACULAR DEGENERATION

by

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ABSTRACT

Evaluating the accuracy of predicted near magnification compared to patient selected devices in low vision patients with a primary diagnosis of Age Related Macular Degeneration.

Background: In low vision practice the majority of patients have a primary diagnoses of age related macular degeneration. Device selection can be overwhelming to patients due to the abundance of options available and is often conducted over several visits. Predicted magnification formulas are used by practitioners to determine the amount of magnification needed for the patient to achieve near acuity goals. By determining the accuracy of these formulas practitioners will employ the most effective and efficient device and power selection strategies to meet the demands of the patient's near activities of daily living. **Methods:** This study is a retrospective chart analysis of 68 patients that presented for examination at the University Eye Center, Vision Rehabilitation Service between the years of 2000 to 2013. Patients charts were selected with a primary diagnoses of age related macular degeneration and had a uncorrected near visual acuity recorded in metric notation (M). Recording of final near device selection was an additional prerequisite for inclusion in the study. The formula V = M x D was utilized where needed mag (D) to read 1M, M is the smallest letter size read in M

notation and D is the dioptric working distance. The result of this formula was then compared to the final near device selected by the patient. Accuracy of the predicted magnification was characterized by the following criteria. An accurate prediction demonstrated a difference of +/- 4D. A non-accurate prediction was categorized into> + 4D (greater than 4D higher than predicted) or >- 4D (greater than 4D lower than predicted). **Results:** The results were analyzed using a distribution plot that represents the spread of subjectively chosen magnification as compared to predicted magnification. An accurate prediction was made for 31 of 97, or 32% of the time. A non-accurate prediction was made for 66 of 97, or 68% of the time. Of the non-accurate predictions 3 of 97, or 3% were greater than 4D below the predicted value, and 63 of 97, or 65% were greater than 4D above the predicted value. The mean difference is +5.525 D from exactly predicting the value of selected magnification. This places the mean only +1.525 D outside of the criteria set for an accurate prediction. **Conclusions***:* According to our criteria*,* the formula does not accurately predict near magnification, patients trend toward powers above what the formula predicts. However most results were within 6D of predicted magnification, and the Pearson Correlation Coefficient shows a strong correlation between the predicted magnification and the prescribed magnification.

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Evaluating the accuracy of predicted near magnification compared to patient selected devices in low vision patients with a primary diagnosis of Age Related Macular Degeneration.

INTRODUCTION

In low vision practice the majority of patients have a primary diagnoses of age related macular degeneration (AMD).[1] AMD is the leading cause of severe visual impairment among the elderly in developed countries.[2] It is estimated that 1.75 million individuals suffer from age related macular degeneration in the United States, and with the aging of the population it is estimated that by 2020 the number of people suffering from AMD will be closer to 3 million.[3]The majority of people in the world who are considered to have low vision are older than 50 years old.[4] Reading is considered to be one of the most important tasks of daily living when it comes to vision rehabilitation.[1,5] The number of patients with AMD who maintain their ability to read is greater among those who have been prescribed an appropriate low vision device than among those who have not.[6] Device selection can be overwhelming to patients due to the abundance of options available and is often conducted over several visits. Predicted magnification formulas are used by practitioners to determine the amount of magnification needed for the patient to achieve near acuity goals. By determining the accuracy of these formulas practitioners will employ the most effective and efficient device and power selection strategies to meet the demands of the patient's near activities of daily living.

In this study the formula V = M x D [Needed mag (D) to read 1M, M is the smallest letter size read in M notation and D is the dioptric working distance] was used. This formula is especially useful because it gives the predicted magnification in diopters. There is not a worldwide convention for marking times of magnification for low vision devices, therefore to easily switch between brands the power of the device in diopters is more useful than the times of magnification.

METHODS

This study was conducted using retrospective chart analysis of patients that presented for examination at the University Eye Center, Vision Rehabilitation Service between the years of 2000 to 2013. Patients must have had their most recent examination before 2004 due to the clinic's policies on destroying old records. A population of 66 patients fit the following requirements. The patient chart had to list a primary diagnosis of age related macular degeneration. A near acuity in M notation had to have been recorded. Due to variation in records, uncorrected near visual acuity, near acuity through a standard addition lens calculated for a 40cm working distance, or any type of habitual spectacle corrected near acuity were used. Final near device selection must also have been recorded. When patients had had more than one examination at which devices were purchased, individual data points were extracted for each visit and device giving 98 data points to be analyzed. The population of patients was 44 Females ages 59 to 98 providing 65 data points, and 22 males ages 62 to 90 providing 32 data points. This is a total of 66 patients ages 59 to 98 and 97 data points.

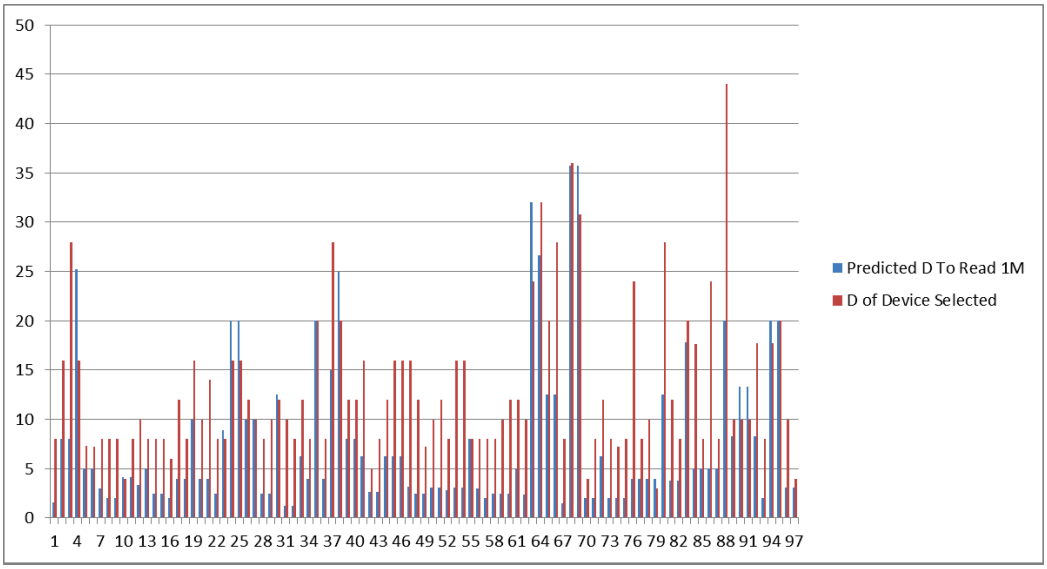
Near acuities gathered in M notation were entered in to the formula V = M x D[Needed mag (D) to read 1M, M is the smallest letter size read in M notation and D is the dioptric working distance]. The result (V) of the formula was then compared to the magnification in diopters of the final near device selected by the patient.

Accuracy of the predicted magnification was characterized by the following criteria. An accurate prediction will show a difference of +/- 4D. A non-accurate prediction was categorized into> + 4D (greater than 4D higher than predicted), or >- 4D(greater than 4D lower than predicted).

RESULTS

Each device selected was compared to final device selected based on dioptric power. These results are represented in figure 1.

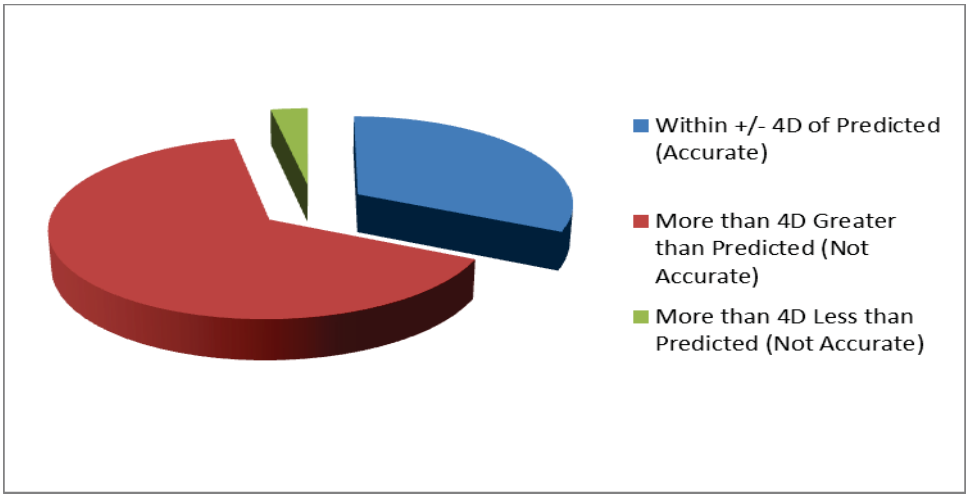
Fig. 1



The analysis of data revealed the following results. An accurate prediction was made for 31 of 97, or 32% of the time. A non-accurate prediction was made for 66 of 97, or 68%

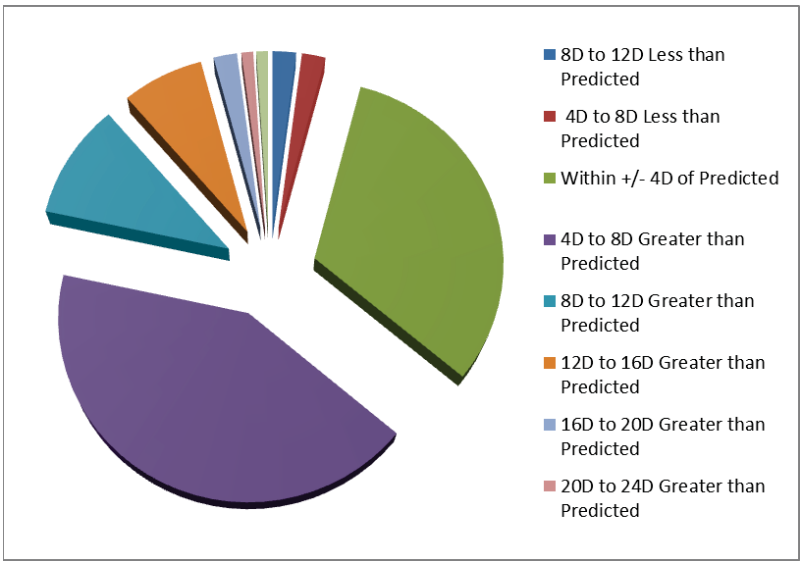
of the time. Of the non-accurate predictions 3 of 97, or 3% were greater than 4D below the predicted value, and 63 of 97, or 65% were greater than 4D above the predicted value. These results are shown in figure 2.

Fig. 2



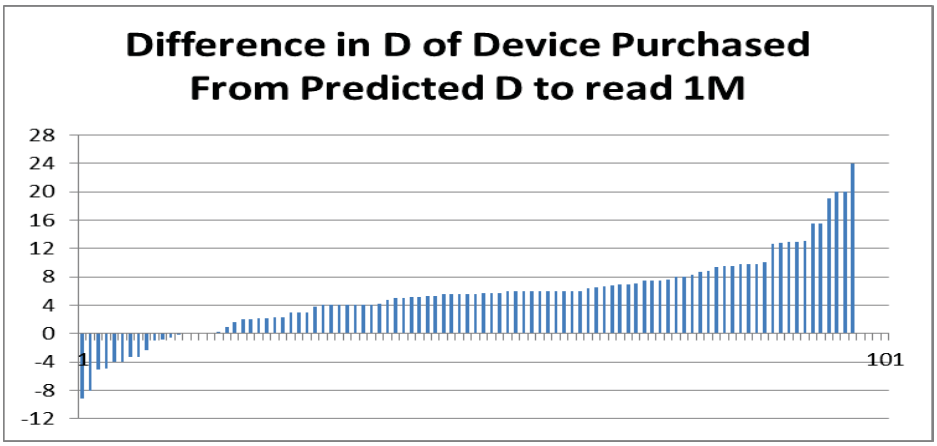
To further evaluate the non-accurate results which were the majority, figure 3 shows the results broken down into 4D steps away from accurate.

Fig. 3



The mean difference is +5.525 D from exactly predicting the value of selected magnification. This places the mean only +1.525 D outside of the criteria set for an accurate prediction. Figure 4 shows the distribution of powers chosen as a difference from predicted, note that all bars between -4 and +4 are considered an accurate prediction.

Fig. 4



Using the Pearson Correlation Coefficient formula a value of 0.722034 was found, showing a high correlation value between prescribed magnification and magnification predicted by the formula.

DISCUSSION

From the results we conclude that the formula V=M x D does not accurately predict magnification power of near devices ultimately selected by patients to purchase. This study did however find a strong correlation value between predicted magnification and selected magnification. It was found that patients trend towards more magnification than the formula predicts. As a practitioner turns to this formula in a clinical setting they should consider patients preference toward more magnification. Other studies have also

shown that magnification predicted by other methods also underestimates prescribed magnification.[5,7] Whenever selecting a near device there is always a compromise between amount of magnification and useful field of view. It seems from these results that patients are willing to sacrifice a certain amount of field of view in order to read a larger print. It has been shown that larger that threshold print allows for a faster reading rate and more fluent reading.[5,8] In a previous study comparing methods of predicting near magnification it was found that the difference between predicted and prescribed magnification was not related to the patients' central visual field status, patient psychology, or the causative condition of visual impairment.[9]

According to the most recent WHO global survey of visual impairment the prevalence of blindness from chronic posterior segment diseases such as macular degeneration, glaucoma, and diabetic retinopathy has surpassed that of blindness from infectious causes such as trachoma and corneal opacities.[4] Patients with these chronic progressive posterior segment diseases can benefit greatly from rehabilitation services. Providing proper low vision aids, patient education about the disease, and peer support have been shown to improve the quality of life of those diagnosed with age related macular degeneration.[10] In addition to prescribing the best low vision aid, task specific training has been proven to significantly increase patient ability to effectively utilize low vision aids.[11,8]

Research into this topic of how best to prescribe low vision aids to patients in order to improve their quality of life should continue in the future. Studies dividing patients into

acuity specific ranges may prove to have more consistent results and more accurate predictions.

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