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James Loughman
Dublin Institute of Technology, james.loughman@dit.ie

John M. Nolan
Waterford Institute of Technology

James Stack
Waterford Institute of Technology

Stephen Beatty
Waterford Institute of Technology

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Online AMD research study for optometrists: current practice in the Republic of Ireland and UK

James Loughman,[1,2] John M Nolan,[3] James Stack[3] and Stephen Beatty[3]

[1]Optometry Department, Dublin Institute of Technology, Dublin, Ireland
[2]African Vision Research Institute, University of KwaZulu Natal, Durban, South Africa. [3]Waterford Institute of Technology, Waterford, Ireland

C-17733 2 CET points for optometrists and therapeutics

Introduction

The macula is a specialised part of the central retina which is responsible for optimal spatial and colour vision. Age-related macular degeneration (AMD) is the leading cause of blind registration in the western world (Bressler 2004). Epidemiological studies carried out in different countries have been remarkably consistent in demonstrating that the prevalence of eye disease, and associated vision loss, is critically age-dependent (Bunce & Wormald 2008; Kelliher et al. 2006). Indeed, for each decade over the age of 40 years, the amount of blindness and vision loss increases threefold. Interestingly, in developed countries, 48% of all cases of blind registration in persons aged 40 years and over are attributable to AMD. AMD is seen in about 2% of the 70–80-year-old age group, 4% in the 81–84-year-old age group and 13% in those aged 85 years and older. It has been estimated that there are currently 80 000 people in the Republic of Ireland (http://www.fightingblindness.ie/) and 417 000 people in the UK (Owen et al. 2003) suffering with AMD and these figures are expected to double by 2020. In fact, the most recent analysis of the blindness register in the Republic of Ireland revealed that the number of persons registered blind as a consequence of AMD more than doubled (113% increase) in the short period from 1996 to 2003 (Kelliher et al. 2006). A similar increasing trend has also been noted in the UK, where AMD was observed to account for 29% of blindness registrations in 1980, but increased to 52% by 1997 (Bamashmus et al. 2004). Given our ever-increasing life expectancy, these upward trends in AMD prevalence and associated blindness are certain to continue, and will cement AMD's position as the most significant sight-threatening condition likely to affect the growing, and ageing, population in the UK and Ireland.

The impact of vision loss, secondary to AMD, manifests as reduced ability to drive, to read, to recognise faces or to perform routine daily visual tasks. There is also a consequential loss of social independence, which is increasingly problematic in an era of declining family support and lengthening periods of retirement. When asked what health condition they fear most, one-third of people will identify blindness, another third will identify cancer and the final third will identify a wide range of ailments or fears. Most people, however, regard it as unlikely that they will ever develop blindness or visual impairment. Indeed, health policy-makers often regard vision loss as being of relatively minor importance or priority. It is worth emphasising that even small degrees of visual impairment have important adverse impacts on both the quality and length of life. For example, vision of 6/12 or less is associated with the following: loss of driving licence; increased risk of falls, hip fractures and depression; loss of social independence; admission to a nursing home 4 years before their counterparts with normal vision; and perhaps most importantly, a reduced ability to enjoy healthy and independent ageing. Such consequences of vision loss are not only costly to the individual in personal terms, they also have significant direct and indirect financial cost implications to the exchequer – costs that continue to escalate.

The aetiology of AMD is poorly understood, yet there is consensus that genetic background and certain environmental/lifestyle risk factors (eg smoking) and their interaction predispose an individual to the condition (Schork 1997). Current treatment interventions, such as anti-vascular endothelial growth factor agents, have resulted in better outcomes for patients with neovascular AMD (Bressler et al. 2010; Brown et al. 2009; Rosenfeld et al. 2006). These, however, are costly and cumbersome to the healthcare provider and patient. In addition, there is no effective treatment for the atrophic (dry) form of late AMD, which has a similarly detrimental effect on a patient's quality of life.

The dietary carotenoids lutein (L), zeaxanthin (Z), and *meso*-zeaxanthin (*meso*-Z) accumulate at the macula where they are collectively known as macular pigment (MP) and give the macula its yellow appearance. L and Z can be obtained from many foods (Sommerburg et al. 1998), whereas *meso*-Z is not present in a conventional western diet, although it can be found in certain types of seafood (Maoka et al. 1986). MP has generated interest in recent years because of its possible protective role in AMD, putatively attributable to its antioxidant properties and/or its prereceptoral filtration of damaging short-wavelength (blue) light (Beatty et al. 2000a; Tomany et al. 2004).

In summary, AMD, which is already at epidemic levels, will continue to increase in prevalence with the ageing and growing population. AMD destroys central vision and impairs quality of life in the elderly. Current treatment options, while effective in some patients, are costly and present a massive and increasing financial challenge for healthcare services

Date of acceptance: 31 August 2011. Address for correspondence: Dr John Nolan, Macular Pigment Research Group, Chemical and Life Sciences, Waterford Institute of Technology, Cork Road, Waterford, Ireland. jmnolan@wit.ie.

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worldwide. There is a clear need, therefore, for attention to be directed towards the prevention of AMD and its progression. The optometrist, who represents the first line of eye care, is uniquely placed to implement such a prevention strategy for AMD. However, it appears that current ophthalmic practice for AMD assessment and prevention may be failing to exploit the latest technological developments and scientific knowledge. It is not clear what methods, if any, are being used to identify patients at risk of AMD, or what preventive methods, if any, are being utilised to help reduce risk of AMD and its progression. This investigator-driven, online AMD research study was designed to address these precise questions for a target population consisting of optometrists in the Republic of Ireland and the UK.

Methods

The Institute of Vision Research (IVR), based in Waterford, Ireland, initiated and designed the current research study. The survey questions asked as part of this online AMD research study (all presented below in the Results section of this report) were prepared by members of the IVR with expertise and input from the following disciplines: ophthalmology, optometry, vision science, nutrition and statistics.

The Association of Optometrists in Ireland and the College of Optometrists in the UK were informed of the study and its objectives, and agreed to contact (by email) their members and invite them to participate in the online AMD survey. Seven hundred and fifty emails were circulated in Ireland and 8049 emails were circulated in the UK. Reminder emails were sent to Association and College members after 6 weeks. The survey was open to members for a total of 3 months. In total, 724 respondents (8.2%) completed and submitted the survey online.

Results and discussion

The 11 questions posed to optometrists as part of this online research study are presented in Table 1.

The majority of practices (81%) reported patient numbers of 5000 per year or less. The reported percentage of patients presenting with AMD ranged from 0 to 90% (Figure 1). The mean ± standard deviation (SD) percentage of patients presenting with AMD was 10.8 ± 10.8. However, some practices reported much higher percentages presenting with AMD. For example, of the 724 practice respondents, 65 reported AMD prevalence in excess of 20% among practice attendees.

The Amsler grid was the most widely reported technique used routinely to check for the presence of AMD (35%). The range of additional techniques employed to detect the presence of AMD can be seen in Figure 2.

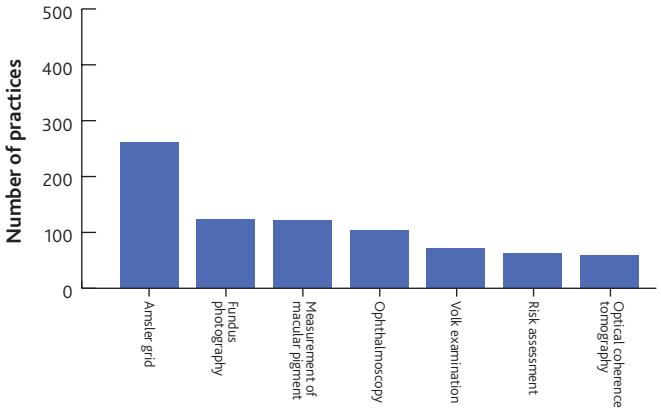

Figure 2. Reported routine age-related macular degeneration (AMD) and AMD risk assessment techniques.

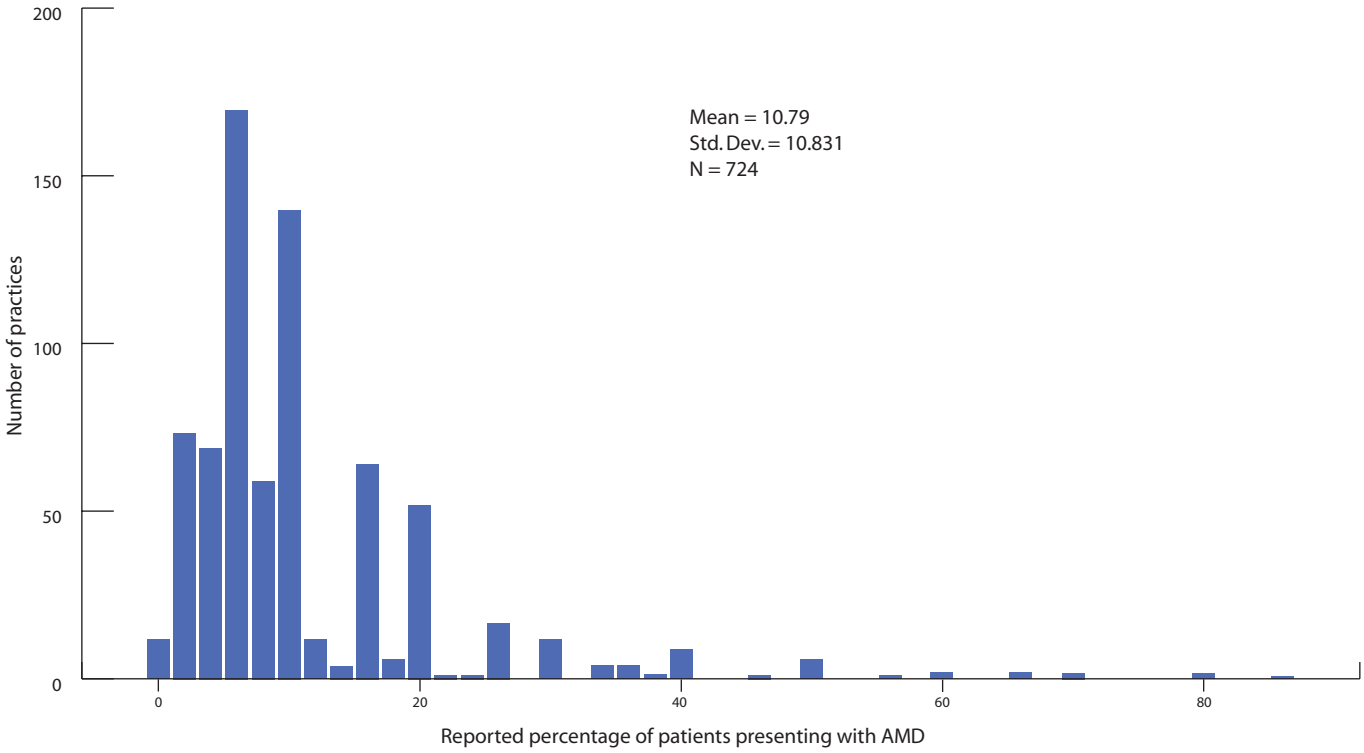

Figure 1. Reported percentage of patients presenting with signs of age-related macular degeneration (AMD).

Table 1. Online questionnaire items

Question no.	Question
1	What is your average annual patient number?
2	Approximately what percentage of your patients present signs of AMD?
3	What assessments do you routinely perform to check for the presence of AMD and/or risk of developing AMD?
4	If you measure macular pigment, which device do you use?
5	Do you currently recommend eye supplements for patients with AMD?
6	Do you currently recommend eye supplements for patients at risk of developing AMD?
7	Which supplements do you recommend for AMD?
8	What is your main reason for not recommending supplements?
9	What factors influence your decision to recommend eye supplements, if any?
10	Within the last 12 months, approximately how many patients have you recommended eye supplements to?
11	Within the last 12 months, approximately how many patients have you noticed, or the patients themselves have reported, an improvement in their AMD following recommendation of the eye nutritional supplement?

Although 16% of respondents to question 3 indicated that measurement of MP comprised part of their routine investigations for AMD, only 3.7% (27 practices) named the MP measurement device they used in response to question 4. Of these, 13 use the Macuscope device, 13 use the Mpod, and one uses the Zeiss Visucam 200. In addition, one respondent reported measuring MP using an ophthalmoscope, and one respondent reported using a Friedmann analyser; however, these devices are not suited to measure MP.

A significant majority of practices (90.6%) are currently recommending eye supplements for patients with established AMD. In addition, 73.2% of respondents indicated that they are currently recommending eye supplements for patients at risk of AMD. ICaps (382 practices, 52.8%) and Macushield (351 practices, 48.5%) are the most recommended supplements for AMD (Figure 3). In those practices recommending only a single supplement, ICaps and Macushield again predominate (Figure 4).

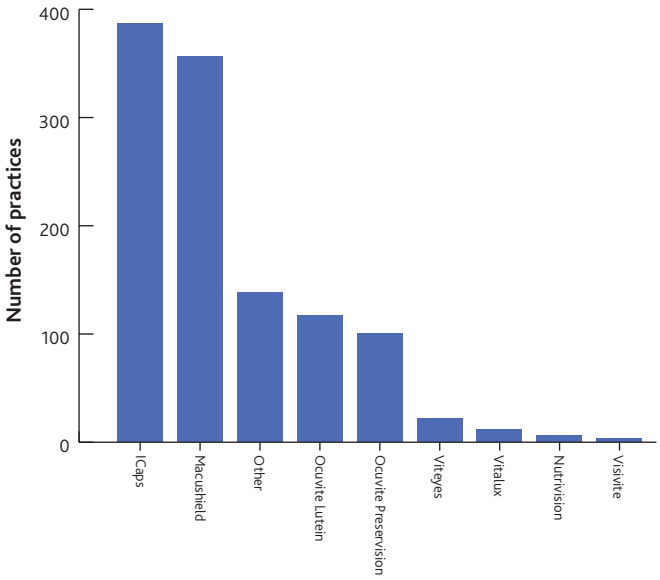

Figure 3. Supplements recommended in optometry practices for age-related macular degeneration. Note that many practices recommend more than one supplement, and therefore the cumulative counts add up to more than the total number of survey respondents.

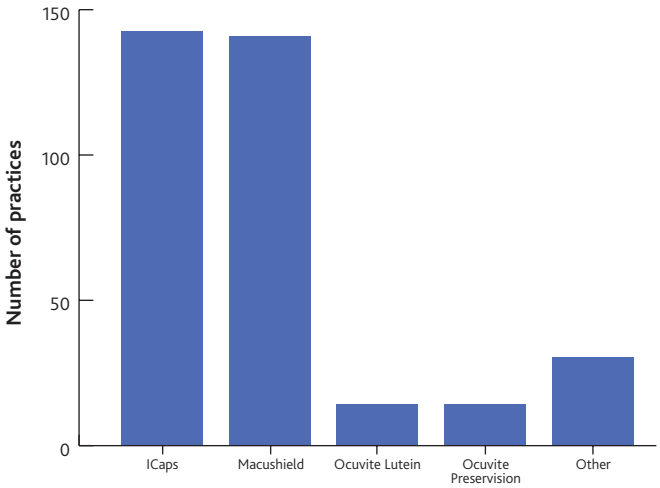

Figure 4. Supplement recommendations in practices recommending a single supplement.

Strong scientific evidence was cited as the principal reason supporting the recommendation of supplements for AMD (Figure 5).

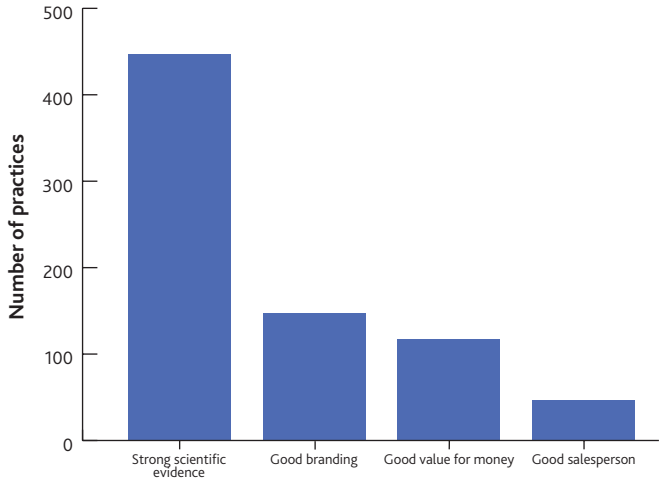

Figure 5. Reasons cited for recommending supplements for age-related macular degeneration.

In the small number of practices (9.4%) not currently recommending such supplements, the reasons for not recommending them were more evenly dispersed, although interestingly, lack of scientific evidence was the most common reason given (Figure 6).

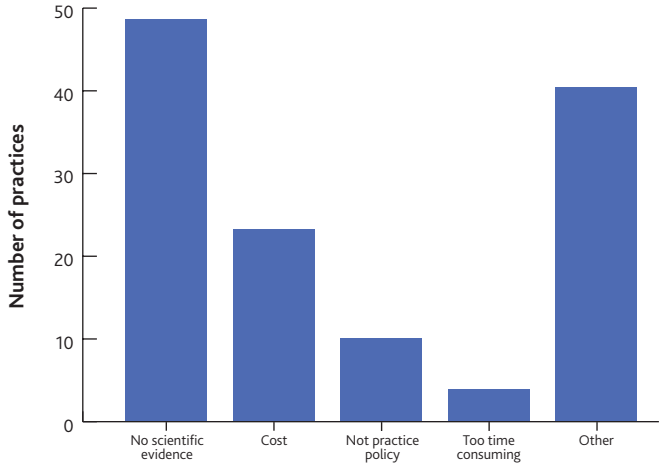

Figure 6. Reasons cited by practices not recommending supplements for age-related macular degeneration.

Presence of clinical signs of the atrophic form of late AMD (including vision loss) was the strongest influencing factor involved in clinical decisions to recommend AMD supplements to a patient. This was closely followed by the presence of early AMD, including signs such as drusen and/or pigmentary changes at the macula, but without significant vision loss. Increased risk of developing AMD was the least commonly cited reason for prescribing supplements (Figure 7).

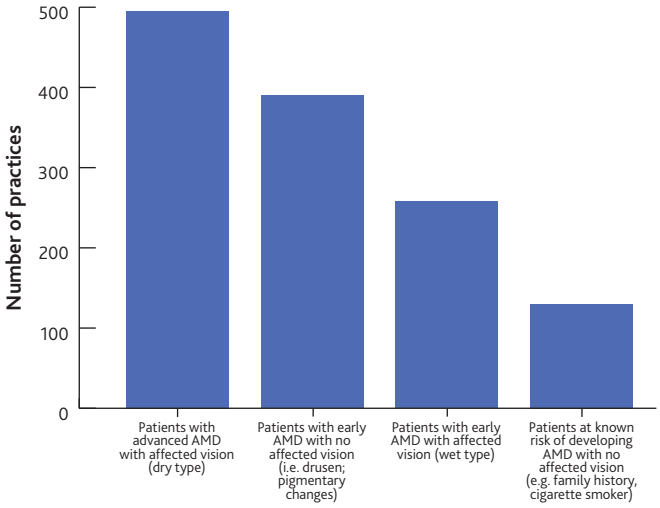

Figure 7. Reasons for prescribing eye supplements. AMD, age-related macular degeneration.

For the majority of practices, supplements were recommended for fewer than 50 patients in the preceding 12 months, while only a small minority of respondents estimated a recommendation rate greater than 200 (Figure 8).

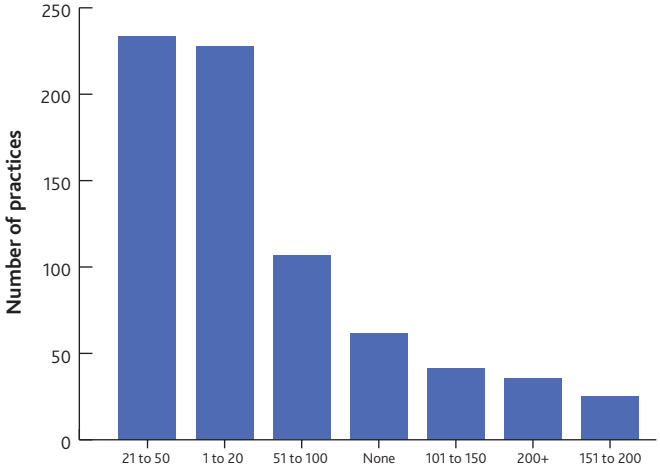

Figure 8. Estimated number of patients to whom eye supplements were recommended in the preceding 12-month period.

In total, 22% (158) of practices reported some form of improvement in at least one of their AMD patients following supplementation (Figure 9). For these practices, patient improvement was noted, on average, in 9% (±11%) of patients to whom supplements had been recommended. For the majority of cases, it was not possible to assign these improvements to any one particular supplement. This was possible, however, for the 265 practices, identified through the survey, that recommend a single supplement, thereby enabling a determination of the relative efficacy of individual supplement types.

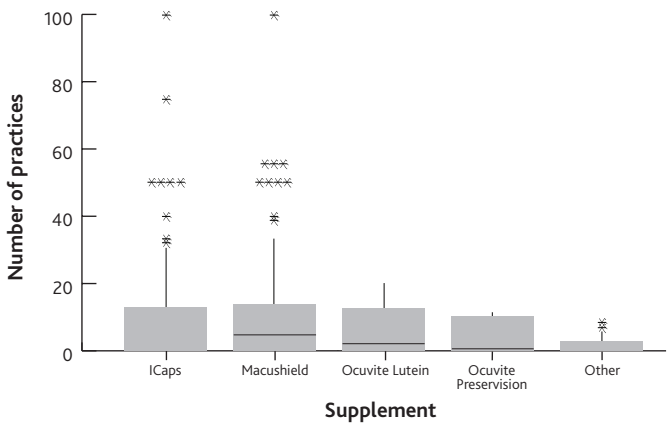

Figure 9. Estimated percentage of patients showing improvement in age-related macular degeneration following supplementation. *Statistical outliers.

The differences in reported improvement across supplement types are presented in Table 2. Treating reported improvement as a simple binary variable (ie yes/no improvement response), Pearson chi-squared analysis reveals a statistically significant difference between the relative improvement between supplements (Pearson chi-squared test, $P = 0.008$). Of note, in Table 2 the reported improvement is highest amongst those practices using Macushield (the only supplement containing *meso*-Z: see below for discussion on this interesting finding). Further statistical analysis of the actual reported percentage improvement for each practice also reveals a significant difference between supplement types (Kruskal–Wallis test, $P = 0.031$). Once again, the percentage improvement is highest in those practices that recommend Macushield exclusively. These findings are illustrated in Figure 9.

Table 2. Improvement in age-related macular degeneration reported for supplements

	Improvement noticed		
Supplement	**No**	**Yes**	**Total**
ICaps	66	46	112
Macushield	42	68	110
Ocuvite Lutein	6	6	12
Ocuvite Preservision	5	5	10
Other	15	6	21

Discussion

This online AMD research study was uniquely designed to investigate current practice for AMD assessment, therapeutic and prevention strategies amongst the optometric communities in the Republic of Ireland and the UK. While the number of respondents ($n = 724$) and response rate (5.27%) are typical of modern online surveys, and remain sufficient for reliable statistical interpretation of the results contained herein, it should be recognised that the responses described may not be wholly reflective of optometric practice across the UK and Ireland. It should also be recognised that some inconsistencies and irregularities in response have been noted, including the number of practices reporting that they measure MP versus the number of respondents who named the MP device routinely used. Also, the responses to question 3 remain somewhat puzzling, with only a minority of respondents indicating the use of fundus evaluation (ophthalmoscopy, Volk biomicroscopy or fundus photography) to assess for the presence of signs of AMD.

Interestingly, the average number of patients presenting with signs of AMD was indicated to be around 10%. Importantly, as the question about the number of patients per annum included all patients, of all ages, a figure of 10% appears somewhat high, but is consistent with the increasing prevalence of AMD in the ageing population, and also with the likely age profile of patients attending optometry practice, which would tend to be skewed to older age. Also, and of interest, a large number of practices reported an extremely high number of people presenting with signs of AMD. This finding is most likely explained by a particularly older age patient profile in these particular practices. This survey did not differentiate the type of practice worked in by the respondents, and it should be recognised that this could influence the high estimated AMD prevalence reported here (for example, if a high percentage of hospital eye service optometrists responded to the survey).

When asked what assessments they routinely perform to check for the presence of AMD and/or risk of their patients developing this condition, it was interesting to note that the Amsler grid was the most commonly reported technique to be used (35%). The low response rate for ophthalmoscopy (14%), Volk examination (8%) or fundus photography (16%) would seem highly surprising, especially given that it is expected that at least one of these techniques would be used during the course of every optometric eye examination, particularly among those patients at risk of developing AMD. While it is encouraging to see newer technologies such as optical coherence tomography (OCT) in use, such techniques could not yet be regarded as routine for optometric practice. Of more concern, however, are the low numbers of practitioners (7%) who report that they routinely perform an AMD risk assessment. Given the nature of the condition, and the treatment options available, it appears sensible that efforts should be made to detect risk of this condition before the disease is allowed to manifest.

MP, made up of the dietary carotenoids L, Z and *meso*-Z, is now believed to play an important role in eye health, particularly for AMD. Indeed, the protective role of this pigment lies in its ability to function as a powerful antioxidant (Beatty et al. 2000b) and as a prereceptoral filter of potentially damaging, short-wavelength blue light (Haegerstrom-Portnoy 1988). It is now accepted that free radical damage caused by oxidative stress, which is exacerbated by irradiation of the retina with blue light, is aetiologically important in AMD. It makes sense, therefore, that an individual's MP is key to reducing these stresses that ultimately lead to AMD (Loane et al. 2008).

It is interesting to note that only a very small percentage of practices (3.7%) currently have the capacity to measure this important dietary pigment for people with, or at risk of, AMD.

Given that this pigment is modifiable by dietary refinement and/or supplementation with the macular carotenoids, and given that enrichment of this pigment is believed to confer protection against AMD, optometrists are now advised to recommend dietary supplements to patients with, or at risk of, AMD. However, it is important that the eye care specialist endeavours to identify response to such dietary modification or supplementation, which can only be achieved by measuring this pigment in vivo. This is important as it is also known that not all individuals respond to supplementation. There are many different supplements available, containing many different formulations and concentrations of the macular carotenoids. Poor or slow response to one supplement might warrant change in recommendation to an alternative supplement.

We believe that the reason for such a small number of eye care specialists in the Republic of Ireland and the UK measuring this pigment is due to the technology that has been available up to now. Indeed, the current accepted gold standard within the scientific community for measuring MP is a technique known as heterochromatic flicker photometry (HFP). It is our view that this subjective technique, which requires customisation of the method and training for the patients, has only been suitable for scientific studies (given the length of time required to customise the stimulus and train the patient – circa 20 minutes per patient). Commercial organisations have tried to promote 'clinical' versions of this flicker technique for the optometrist; however, this has not been successful, as confirmed by the current survey results showing the very small number of practices actually using their techniques. For example, the Macuscope uses a type of HFP to measure MP, but fails to allow for customisation of the method. This, in our opinion, results in a far too difficult and unreliable measurement. Another instrument, the M-POD, which again uses a type of HFP to measure MP, has significantly improved the measurement technique. It can, however, occasionally prove difficult for some patients, and tends to yield lower results compared to the gold-standard device. A new device, known as the clinical densitometer, appears to have successfully addressed most of the earlier problems with the measurement of MP in clinical practice, and produces reliable and reproducible results that, in our opinion, have the potential to bring value to the optometry community and its patient base. Importantly, using these newer technologies, this measurement now takes only a few minutes to perform and the data obtained are reliable, making it suitable for the clinical setting.

It was no surprise to see that over 90% of practices currently recommend some form of nutritional eye supplement. Interestingly, when asked if they recommend supplements for patients at risk of AMD (ie currently not presenting with disease but believed to be at risk due to a positive family history or other combined risk profile), it was encouraging to see a high percentage of practices (n > 70%) making such a recommendation. This recommendation is consistent with the scientific view that risk reduction for AMD, which includes retinal enrichment with the macular carotenoids, needs to be established before the disease is allowed to develop to achieve maximum effect. Indeed, given that AMD is the result of cumulative and chronic damage caused by free radicals over a person's lifetime, it makes sense that preventive methods are implemented during this same time period.

Given the estimated percentage of patients with AMD attending for optometric examination (10.8%), it is perhaps surprising to note the relatively low rates of recommendation of nutritional supplements. For the majority of practices, the estimated number of recommendations is less than one per week, with very few practices reporting more than four recommendations per week. Given the prevalence of AMD, the likely age profile of patients attending optometry practices, and the prevalence of confirmed risk factors for AMD such as smoking, this likely represents a significant underexploitation of nutritional supplementation for AMD and AMD risk.

In response to the question as to what actual type (brand) of supplement was recommended, the results clearly show that ICaps (containing 10mg L/Z plus antioxidants) and Macushield (containing 10mg L, 10 mg *meso*-Z and 2 mg Z) are the two leading choices amongst the optometry communities in the Republic of Ireland and the UK. Of the 724 respondents, 382 recommend ICaps and 351 recommend Macushield, and these remain the most commonly recommended supplements regardless of whether practices stock just one or more than one supplement.

When queried on the reasons for recommending their chosen eye supplement over others, 'strong scientific evidence' was the main reported reason for supplement choice. It appears, therefore, that the optometry community in the Republic of Ireland and the UK feels that the supplements they recommend (ie mainly ICaps and Macushield) have the most scientific support to justify such recommendations. However, it is important to point out that, for the leading recommended supplement, ICaps, this is not the case. This point is supported by the fact that, to our knowledge, there is not a single published scientific study in the literature that has commented on response, safety and/or suitability of the ICaps supplement for patients with or at risk of AMD. In contrast, however, the Ocuvite Lutein supplement has, indeed, many supporting published studies commenting on the suitability of this supplement for patients with or at risk of AMD (Loughman et al. 2010; Nolan et al. 2011; Trieschmann et al. 2007). The second most recommended supplement, Macushield, also has a growing body of scientific evidence in support of this particular supplement for patients with or at risk of AMD (Bone et al. 2007; Connolly et al. 2010).

There are many different types of L available (eg free versus ester), in different formulations and concentrations, which may influence how the patient responds to the supplement. It is important, therefore, that the optometrist is informed of these facts, and understands that patients' response to supplements is not consistent across the many supplements available. In summary, therefore, the optometrist is advised to seek appropriate scientific data (eg from clinical trials) providing information on response, safety of consumption and efficacy for AMD when deciding on which supplement to recommend to patients.

The final objective of this research survey was to try and identify whether signs and symptoms of AMD were improved in patients using supplements recommended by the practice (optometrist). Although this aspect required respondents to make a subjective analysis of their clinical experience of

supplementation (question 11), robust statistical analysis confirmed that there was a statistically significant difference with respect to the reported efficacy of supplements, which was dependent on the actual supplement recommended, and was in favour of Macushield. This finding, albeit provocative, is important given that Macushield is the only commercially available supplement that contains all three of the macular carotenoids, including the central carotenoid, *meso*-Z. Indeed, the view of these clinical optometrists is consistent with recently published scientific studies which confirm significant enrichment of MP in individuals following supplementation with this particular carotenoid supplement (Connolly et al. 2010). It is also consistent with a recently published study confirming the enhanced antioxidant capacity of the carotenoids when all three are present in formulation (as opposed to any of the individual carotenoids at the same concentration) (Li et al. 2010).

This online AMD research survey has provided valuable information as to current practice amongst Irish and UK optometrists for AMD. It is clear from this survey that AMD continues to present a challenge to the optometry community. Current methods to assess and manage risk of AMD are improving; however, the optometrist is advised to consider advanced technologies such as OCT, and in particular, to consider incorporating the measurement of MP into routine optometric practice. This should form part of an overall formal AMD risk assessment strategy, aimed at identifying those patients at highest risk of developing AMD (such as those with low MP, family history of AMD and smokers) and suffering the associated visual losses and lifestyle effects of such visual impairment within their lifetime. Research in the area of AMD prevention, particularly around nutrition and macular carotenoids, is ongoing and supports (albeit inconclusively as of yet) the role of the macular carotenoids for AMD and for the 'at-risk' patient. When making recommendations on nutritional supplements, the optometrist should base such recommendations on supporting and available scientific studies on carotenoids/antioxidants and AMD. It is our view that the scientific literature is in favour of a supplement that contains all three macular carotenoids.

It is encouraging to see the optometry community reporting many cases of improved AMD (albeit crudely assessed and reported) following recommendation of nutritional eye supplements. However, further work is required to understand such benefits fully, in order to try to identify the type of patient who could benefit most from such recommendations. There are now several clinical trials underway investigating the potential of nutritional supplementation for AMD, including a major European-funded study about to commence in Waterford, Ireland. These studies have the capacity to address the outstanding issues more completely and provide more definitive information on the role of MP supplements in AMD.

In conclusion, the optometrist who represents a very important first line of eye care is advised to review the scientific literature on this ever-growing topic regularly. Indeed, it is important that the totality of the available evidence is examined, which, for now, suggests a positive role for the macular carotenoids, L, Z and *meso*-Z for patients at risk of, or presenting with, AMD.

Summary

Age-related macular degeneration (AMD) is the leading cause of blind registration in the western world, and the number of people with this condition continues to rise due to the ageing population. AMD destroys central vision and impairs quality of life in the elderly. Current treatment options, while effective in some patients, are costly and present a massive financial challenge for Europe and its healthcare services. There is a clear need, therefore, for attention to be directed towards the prevention or delay of AMD and its progression. The optometrist, who represents the first line of eye care, is uniquely placed to implement such a prevention strategy for AMD.

This paper reports and discusses findings from an online AMD research survey, designed to investigate current practice for AMD amongst optometric practitioners in the Republic of Ireland and the UK.

References

- Bamashmus MA, Matlhaga B, Dutton GN (2004) Causes of blindness and visual impairment in the West of Scotland. *Eye (Lond)* **18**, 257–61
- Beatty S, Koh H, Phil M et al. (2000a) The role of oxidative stress in the pathogenesis of age-related macular degeneration. *Surv Ophthalmol* **45**, 115–34
- Beatty S, Koh HH, Henson D et al. (2000b) The role of oxidative stress in the pathogenesis of age-related macular degeneration. *Surv Ophthalmol* **45**, 115–34
- Bone RA, Landrum JT, Cao Y et al. (2007) Macular pigment response to a supplement containing *meso*-zeaxanthin, lutein and zeaxanthin. *Nutr Metab (Lond)* **4**, 12
- Bressler NM (2004) Age-related macular degeneration is the leading cause of blindness. *JAMA* **291**, 1900–1
- Bressler NM, Chang TS, Suner IJ et al. (2010) Vision-related function after ranibizumab treatment by better- or worse-seeing eye: clinical trial results from MARINA and ANCHOR. *Ophthalmology* **117**, 747–56
- Brown DM, Michels M, Kaiser PK et al. (2009) Ranibizumab versus verteporfin photodynamic therapy for neovascular age-related macular degeneration: two-year results of the ANCHOR study. *Ophthalmology* **116**, 57–65
- Bunce C, Wormald R (2008) Causes of blind certifications in England and Wales: April 1999–March 2000. *Eye* **22**, 905–11
- Connolly EE, Beatty S, Thurnham DI et al. (2010) Augmentation of macular pigment following supplementation with all three macular carotenoids: an exploratory study. *Curr Eye Res* **35**, 335–51
- Haegerstrom-Portnoy G (1988) Short-wavelength-sensitive-cone sensitivity loss with ageing: a protective role for macular pigment? *J Opt Soc Am A* **5**, 2140–4
- Kelliher C, Kenny D, O'Brien C (2006) Trends in blind registration in the adult population of the Republic of Ireland 1996–2003. *Br J Ophthalmol* **90**, 367–71

- Li B, Ahmed F, Bernstein PS (2010) Studies on the singlet oxygen scavenging mechanism of human macular pigment. *Arch Biochem Biophys* **504**, 56–60
- Loane E, Kelliher C, Beatty S et al. (2008) The rationale and evidence base for a protective role of macular pigment in age-related maculopathy. *Br J Ophthalmol* **92**, 1163–8
- Loughman J, Akkali MC, Beatty S et al. (2010) The relationship between macular pigment and visual performance. *Vision Res* **50**, 1249–56
- Maoka T, Arai A, Shimizu M et al. (1986) The first isolation of enantiomeric and *meso*-zeaxanthin in nature. *Comp Biochem Physiol B* **83**, 121–4
- Nolan JM, Loughman J, Akkali MC et al. (2011) The impact of macular pigment augmentation on visual performance in normal subjects: COMPASS. *Vision Res* **51**, 459–69
- Owen CG, Fletcher AE, Donoghue M et al. (2003) How big is the burden of visual loss caused by age related macular degeneration in the UK? *Br J Ophthalmol* **87**, 312–17
- Rosenfeld PJ, Brown DM, Heier JS et al. (2006) Ranibizumab for neovascular age-related macular degeneration. *N Engl J Med* **355**, 1419–31
- Schork NJ (1997) Genetics of complex disease: approaches, problems, and solutions. *Am J Respir Crit Care Med* **156**, S103–9
- Sommerburg O, Keunen JE, Bird AC et al. (1998) Fruits and vegetables that are sources for lutein and zeaxanthin: the macular pigment in human eyes. *Br J Ophthalmol* **82**, 907–10
- Tomany SC, Cruickshanks KJ, Klein R et al. (2004) Sunlight and the 10-year incidence of age-related maculopathy: the Beaver Dam Eye Study. *Arch Ophthalmol* **122**, 750–7
- Trieschmann M, Beatty S, Nolan JM et al. (2007) Changes in macular pigment optical density and serum concentrations of its constituent carotenoids following supplemental lutein and zeaxanthin: the LUNA study. *Exp Eye Res* **84**, 718–28

Multiple choice questions

This paper is reference C-17733. Two points are available for optometrists and therapeutics. Please use the inserted answer sheet. Copies can be obtained from Optometry in Practice Administration, PO Box 6, Skelmersdale, Lancashire WN8 9FW. There is only one correct answer for each question.

1. For each decade over the age of 40 how much does the amount of blindness and visual loss increase?

(a) Twofold
(b) Threefold
(c) Fourfold
(d) Fivefold

2. Vision of 6/12 or less is associated with which of the following:

(a) Increased risk of falls
(b) Depression
(c) Loss of social independence
(d) All of the above

3. Regarding macular carotenoids, which of the following statements is incorrect?

(a) Macular pigment consists of three dietary carotenoids
(b) *Meso*-zeaxanthin is present in a conventional western diet
(c) Lutein can be obtained from many foods
(d) Macular pigment can filter blue light

4. Which of these techniques was most often employed to check for the presence of AMD?

(a) Ophthalmoscopy
(b) Retinal photography
(c) Amsler grid
(d) Measurement of macular pigment

5. What percentage of respondents are currently recommending eye supplements for patients at risk of AMD?

(a) 90.6%
(b) 73.2%
(c) 52.8%
(d) 48.5%

6. Which of the following was the strongest influence when deciding whether to recommend eye supplements to a patient?

(a) Presence of drusen
(b) Presence of pigmentary changes
(c) Family history of AMD
(d) Signs of late AMD

7. What percentage of practices reported some improvement in at least one of their AMD patients following supplementation?

(a) 20%
(b) 22%
(c) 24%
(d) 26%

8. Which one of the following supplements showed the highest improvement in AMD?

(a) Macushield
(b) ICaps
(c) Ocuvite Lutein
(d) Ocuvite Preservision

9. What percentage of patients currently have the capacity to measure macular pigment in people at risk of AMD?

(a) 3.2%
(b) 3.7%
(c) 4.2%
(d) 4.7%

10. Regarding measuring macular pigment, which of the following statements is incorrect?

(a) Heterochromic flicker photometry (HFP) is the gold standard
(b) The Macuscope allows customisation of the method
(c) The M-POD can yield lower results compared to the gold standard
(d) The clinical densitometer produces reliable and reproducible results

11. Regarding eye supplements, which of the following statements is incorrect?

(a) ICaps and Macushield were the two most commonly recommended supplements
(b) Ocuvite Lutein has many supporting published studies
(c) Macushield has a growing body of evidence in support of this supplement
(d) ICaps has many supporting published studies

12. Which combination of macular carotenoids is most appropriate for patients at risk of, or presenting with, AMD?

(a) Lutein and zeaxanthin
(b) Lutein alone
(c) Lutein and *meso*-zeaxanthin
(d) Lutein, zeaxanthin and *meso*-zeaxanthin

CPD Exercise

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Once you have downloaded the details of the article, answer the reflective questions to complete the CPD activity.

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Reflection

1. What impact has your learning had, or might it have, on:
   - your patients or other service users (eg those who refer patients to you, members of staff whom you supervise)?
   - yourself (improved knowledge, performance, confidence)?
   - your colleagues?

2. How might you assess/measure this impact?

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