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The National Eye Institute Visual Function Questionnaire in the Macular Telangiectasia (MacTel) Project

Traci E. Clemons[1], **Mark C. Gillies**[2], **Emily Y. Chew**[3], **Alan C. Bird**[4], **Tunde Peto**[4], **Maria Figueroa**[1], and **Molly W. Harrington**[1] **for the MacTel Research Group**[5]

[1] The EMMES Corporation, Rockville, Maryland [2] Department of Clinical Ophthalmology, Save Sight Institute, University of Sydney, Sydney, Australia [3] National Eye Institute, Bethesda, Maryland [4] Institute of Ophthalmology and Moorfields Eye Hospital, London, United Kingdom.

Abstract

Purpose—To describe vision-targeted health-related quality of life (HR-QOL), measured with the National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25) in a cohort of patients with macular telangiectasia (MacTel) type 2 and to evaluate the relationship between visual acuity and NEI-VFQ-25 scores.

Methods—This was an analysis of cross-sectional baseline data from a longitudinal natural history study. Patients with MacTel type 2 were enrolled in the Natural History Study of The Macular Telangiectasia Project (The MacTel Project). NEI-VFQ-25 were completed at enrollment. Linear correlation and regression analyses were used to relate baseline NEI-VFQ-25 overall and subscale scores to visual acuity.

Results—Participants reported lower vision-related functioning measured by the NEI-VFQ-25 in most of the domains measured by the NEI VFQ compared with that of a normal reference group ($P < 0.001$ for all domains except color vision). Visual acuity was found to be associated with the NEI-VFQ-25 in many of the domains measuring degree of difficulty with common visual activities.

Conclusions—This is the first cross-sectional cohort study to assess vision targeted HR-QOL in patients with MacTel type 2. Patients with MacTel type 2 reported markedly reduced visual functioning compared to reports of a normal reference group. These findings provide support to the use of the NEI-VFQ-25 in patients with MacTel type 2 to measure the effect of disease and potential therapies on vision-targeted HR-QOL.

Macular telangiectasia (MacTel) type 2, a type of idiopathic MacTel,[1–4] is an uncommon condition of bilateral irregular capillary dilation and incompetence in the macula. Visual acuity at presentation usually ranges from 20/25 to 20/40, although vision as poor as 20/200 may occur. The disease is typically diagnosed in the fifth or sixth decade of life. The maculae of these patients exhibit retinal juxtafoveolar telangiectasia, minimal exudation, superficial retinal crystalline deposits, and right-angle venules. As the disease progresses, intraretinal pigment plaques and subretinal neovascularization may develop. The

Corresponding author: Traci E. Clemons, The MacTel Project Coordinating Center, The EMMES Corporation, 401 N. Washington Street, Suite 700, Rockville, MD 20850-1707; tclemons@emmes.com..
[5]See the Appendix for the members of the MacTel Research Group.

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pathogenesis of the disease is unknown. Its classification was reported originally by Gass et al.[2,3] and recently was revised by Yannuzzi et al.[5] This group of diseases is now referred to as MacTel types 1 and 2. Type 1 MacTel, is considered to be aneurysmal, with dilated retinal capillaries easily detected clinically in the macular area, and fluorescein leakage is readily evident. These patients are primarily male, with unilateral disease. The condition that we evaluated in this study is MacTel type 2, either the nonproliferative type or the proliferative type in which neovascularization is present.

The MacTel project is an international observational clinical study designed to evaluate the structural and functional changes associated with MacTel type 2 over a 5-year period. In addition, a group of laboratories with complimentary expertise is assessing the pathobiology of the disease to improve the understanding of its pathogenesis and potential treatment. The project includes 22 clinical centers in seven countries with laboratories in three different countries.

Increasing attention has been given to the assessment of health-related quality of life (HR-QOL) outcome measures in patients with eye disease.[6] The National Eye Institute Visual Function Questionnaire (NEI-VFQ-25) was constructed to evaluate the effect of visual disability on HR-QOL across several common eye conditions.[7,8] The NEI-VFQ-25 has been incorporated into research studies, and findings have been reported for patients with conditions such as AMD, diabetic retinopathy, optic neuritis, glaucoma, uveitis, dry eye, and general low vision.[9–18]

An assessment of vision-targeted HR-QOL in a cohort of patients with MacTel type 2 is important because it will help in understanding the natural history of the disease and how it may affect the daily lives of patients with MacTel type 2. Nothing is known about the vision-targeted HR-QOL among patients with MacTel type 2. Nearly all patients with MacTel type 2 have some degree of visual impairment in both eyes, and a minority has severe visual loss sometimes due to development of neovascularization that may be intraretinal and choroidal.

The purpose of this study was to provide the first large-cohort assessment of vision targeted HR-QOL as measured by the NEI-VFQ-25 in patients with MacTel type 2. We also assessed the association between visual function and vision-targeted HR-QOL.

Methods

Design and Procedures

We studied patients with MacTel Type 2 who were enrolled in the MacTel Project's Natural History Study, a multicenter observational study conducted in 22 clinical centers in seven countries. Each center was granted approval to conduct the study by their institutional review board or independent ethics committee. The eligibility criteria for the study required the participant be at least 18 years of age with a diagnosis of MacTel type 2 made clinically at each clinical center and confirmed on fundus photographs, ocular coherence tomography, fluorescein angiographs, or autofluorescence image gradings performed by the Fundus Reading Center of Moorfields Eye Hospital.

A total of 243 participants were enrolled in the study between November 17, 2005, and January 15, 2007. After signing the informed consent, in accordance with the Declaration of Helsinki, each participant had a comprehensive dilated ophthalmic examination and completed a health and family history interview. Best corrected visual acuity[19] was measured by trained examiners using a standardized protocol and Early Treatment for Diabetic Retinopathy Study (ETDRS) visual acuity charts.[20,21]

At the baseline visits, the 25-item NEI-VFQ-25 (http://www.rand.org/health/surveys_tools/vfq/) was administered to participants by the clinical center coordinator. The NEI-VFQ-25 is the short form of the NEI-VFQ Field Test Version that was developed to include general health, general vision, ocular pain, near vision activities, distance vision activities, social functioning, vision-specific role difficulties, vision-specific mental health, dependency because of vision, driving, peripheral vision, and color vision.[9]

Item responses were transformed to a scale of 0 to 100. The overall NEI-VFQ-25 score was calculated as the average of the 25 items, whereas the subscale scores were the averages of the responses to items within each subscale. Both the overall and subscale scores range from 0 to 100, with higher scores indicating better vision-targeted HR-QOL.

Statistical Methods

Demographic and visual acuity characteristics for participants were summarized with descriptive statistics. The NEI-VFQ-25 subscale scores were computed according to published algorithms.8 A mean (SD) for the overall NEI-VFQ-25 and for each subscale was computed. The subscale means were compared with those of a reference group of 122 normal subjects derived from the field test of the NEI-VFQ-25.9 The relation of visual acuity to vision-targeted HR-QOL was evaluated by assessing the magnitude of Spearman's rank correlation coefficients22 between the better eye and worse eye visual acuity and the scores from the NEI-VFQ-25. Associations of visual acuity and vision-targeted HR-QOL were also evaluated by comparing the age, sex, and disease type (nonproliferative versus proliferative disease) adjusted mean differences in scores within ordered visual acuity categories (20/32 or better in both eyes, worse than 20/32 in one eye, or worse than 20/32 in both eyes) using a test of trend. The Dunnett multiple-comparisons test23 was used to identify significant differences in scores within the visual acuity categories by comparing each level with the reference level (20/32 or better in both eyes). Tests for trend in the linear models were performed by using linear contrasts. Internal consistency and reliability were assessed with Cronbach's α24 for the eight multi-item subscales of the 25-item NEI-VFQ. All analyses were performed with commercially available statistical software (SAS, ver. 8.02; SAS Institute, Cary, NC).

Results

Two hundred twenty-two (91%) of 243 participants enrolled in the Natural History Study completed the baseline 25-item NEI-VFQ and are included in this report. Twenty-one participants were excluded from the analysis because they did not have a confirmatory diagnosis of MacTel type 2 by the Reading Center. A summary of the baseline characteristics is provided in Table 1. The mean (± SD) age of the population was 61 (±9) years (range, 36–83 years) at the time the questionnaire was administered. Approximately 60% of the participants were women and 88% were Caucasian. According to letter scores, the mean visual acuity for the better eye of the participants was 75 (±11) letters (Snellen equivalent, ~20/32). Thirteen percent of the participants had proliferative disease defined as neovascularization, as detected on fundus photographs or OCT, or receiving treatment specifically for neovascularization. Fifty-one participants (23%) had received treatment for MacTel type 2. The mean duration of disease in the population was 3.7 (±4.3) years. The mean visual acuity of the worse eye was 61 (±17) letters (Snellen equivalent, ~20/62.5). Forty percent of the participants had visual acuity worse than 20/32 OU at the time the questionnaire was administered.

Mean (SD) and median baseline NEI-VFQ-25 scores, proportions of participants with a perfect score (100 points, ceiling) and with the lowest possible score (0 points, floor), and

internal consistency estimates for the eight subscales with multiple items are presented in Table 2. The mean overall score on the NEI-VFQ-25 was 77, with a median of 80. The median score was less than 85 on half of the subscales (general health, general vision, near activities, distance activities, mental health, and role difficulties). Some of the subscales, in particular the ocular pain, social functioning, dependency, color vision and peripheral vision, had large ceiling effects where a substantial percentage of participants (>25%) had the highest possible scores, whereas very few participants had subscale scores of 0. The internal consistency estimates for the NEI-VFQ-25 subscales as measured by Cronbach's α, ranged from 0.48 to 0.79. With the exception of ocular pain and driving (Cronbach's $\alpha = 0.66$ and 0.48, respectively), the subscales had similar internal consistency estimates as those found by the developers[9] (Cronbach's $\alpha \geq 0.70$ for all the eight multi-item subscales). The six of eight subscales with Cronbach's $\alpha \geq 0.70$ demonstrated a moderately strong internal consistency and reliability within this cohort of patients with MacTel type 2.

To develop a shorter version of the NEI-VFQ-51 item questionnaire consisting of 25 questions, researchers tested participants with various eye diseases and a control/reference group free of eye disease. Mean subscale scores from the MacTel type 2 cohort were compared with those of the reference group.[8] Subscale NEI-VFQ-25 scores were markedly lower in patients with MacTel type 2 than in the reference group from the NEI-VFQ-25 field test (Fig. 1). More specifically, mean scores of patients with MacTel type 2 from five subscales including role difficulties, mental health, near vision, and distance vision, were ~20 points below the mean scores of the reference group. Similar mean scores between the reference and MacTel type 2 groups were apparent in only the color vision subscales (98 vs. 97). All differences, except for color vision, were statistically significant ($P < 0.001$).

Rank correlations between the NEI-VFQ-25 subscale scores and best and worse visual acuity are provided in Table 3. Correlations ranged from small (0.14) to moderate (0.38), except for the ocular pain subscale, which showed a negligible correlation (0.04). Correlations with visual acuity in the better eye and scores on the NEI-VFQ-25 were statistically significant ($P < 0.01$) for all NEI-VFQ-25 subscales except ocular pain and mental health. Moderate correlations corresponded to subscales, such as general vision, near activities, distance activities, and driving, which measure the degree of difficulty with common visual activities. The correlations of NEI-VFQ-25 overall and subscale scores with visual acuity of the worse eye were similar to those with the visual acuity of the better eye, probably because MacTel type 2 is a bilateral disease.

Mean NEI-VFQ-25 subscale scores by participants' age, sex, race, and disease type were computed (data not shown). Univariate analyses showed that the mean overall NEI-VFQ-25 score of older participants was significantly higher than that of younger participants. The older age groups (≥70 years) had significantly higher scores on average than did the younger age group (≤55 years) on the subscales relating to near activities, distance activities, mental health, role difficulties, and dependency. This result, showing higher NEI-VFQ-25 scores in older persons with MacTel type 2, differs from that found for other cohorts in which the mean overall NEI-VFQ-25 score was found to be significantly lower in persons who were older.[10,13] The distribution of visual acuity in the worse and better eyes did not show the same phenomenon. The visual acuity in the better eye in the younger and older age groups did not differ (74 letters vs. 73 letters, respectively). In addition, the visual acuity in the worse eye in the two age groups did not differ (61 letters vs. 60 letters, respectively).

The mean overall NEI-VFQ-25 score differed significantly by sex, with the men having a significantly higher mean score than did the females (81 vs. 75). In addition, the men had higher mean scores on the near activity (76 vs. 65), distance activity (82 vs. 72), mental health (75 vs. 66), dependency (92 vs. 85), driving (83 vs. 66), and peripheral vision (90 vs.

83) subscales. The mean overall NEI-VFQ-25 score differed significantly by disease type. Participants with proliferative disease had a significantly lower mean score than did participants with nonproliferative disease (67 vs. 79). In addition, participants with proliferative disease had significantly lower mean scores on all subscales except general health, ocular pain, color vision, and peripheral vision. Caucasian participants had a higher, yet not significant, mean overall NEI-VFQ-25 score than did non-Caucasians (78 vs. 73, respectively; $P = 0.034$). Caucasians had significantly higher scores than did non-Caucasians on subscales relating to distant activities (77 vs. 67), social functioning (94 vs. 88), and peripheral vision (87 vs. 76).

Participants treated for MacTel type 2 had significantly lower social functioning subscale scores than did participants not treated for MacTel type 2 (88 vs. 94), whereas there was a significant linear relationship between duration of disease and NEI-VFQ-25 score for the near activities and role difficulties (data not shown). The near activities score for participants newly diagnosed with MacTel type 2 at enrollment (duration equal to 0 years) was 73 compared with 76 in participants with a duration of disease equal to 3 years before enrollment, whereas the role difficulties score of participants newly diagnosed with MacTel type 2 at enrollment was 75 compared with 79 in participants with a duration of disease equal to 3 years before enrollment (data not shown). The overall mean NEI-VFQ-25 score and subscale scores were compared across sites located in North America (United States), Europe (Germany, France, and the United Kingdom), Israel, India, and Australia (data not shown). There was no significant difference in the overall NEI-VFQ-25 mean score and only the mean scores from the general health and mental health subscales were found to be significantly different across the five regions ($P < 0.01$).

The NEI-VFQ-25 overall and subscale mean scores adjusted for age, sex, race, and disease type are presented in Table 4. The test for trend indicated a progressive trend ($P < 0.01$) toward dysfunction, as reflected by the overall NEI-VFQ-25 score and most of the subscales, between participants with the unilateral and bilateral forms of vision impairment. The differences between the group with vision worse than 20/32 in both eyes and the group with 20/32 or better in both eyes were primarily responsible for this association, as demonstrated by the significant results of the Dunnett multiple comparisons test. Participants with vision worse than 20/32 in at least 1 eye had moderately lower scores (yet did not reach statistical significance) for the overall NEI-VFQ-25 and all subscales except ocular pain compared with participants with vision 20/32 or better in both eyes. Scores of participants with vision worse than 20/32 in both eyes were markedly lower ($P < 0.01$) on the overall NEI-VFQ-25 and the general vision, near activity, dependency, and driving subscales compared with participants with vision 20/32 or better in both eyes. Participants with worse than 20/32 vision in both eyes reported the most difficulty (mean score ≤70 and significantly different from the reference mean) with general vision, near activities, and driving. Scores for participants with vision worse than 20/32 in both eyes remained significantly lower after further adjustment for treatment for MacTel type 2 and duration of disease for the overall score and the general vision, near activities, dependency, and driving subscales.

Table 5 provides the mean NEI-VFQ-25 subscale scores for MacTel type 2 patients for comparison with published scores for other cohorts of patients with eye diseases.[9,10,15,18] The mean age, percentage who were women, and the mean visual acuity in the better eye are provided if available within the cited publication. NEI-VFQ-25 subscale scores for this cohort of patients with MacTel type 2 are similar to those found for participants with preoperative age-related cataract (column F, Table 5). For most subscales, patients with MacTel type 2 had worse scores than those of patients with acute optic neuritis, early age-related macular degeneration in the Complications of Age-Related Macular Degeneration

Prevention Trial (CAPT),[12] glaucoma, cytomegalovirus retinitis, and dry eye (columns A, B, E, G, H, Table 5). The last column of Table 5 provides a ranking of the MacTel type 2 mean subscale scores (from worse score to better score) among mean scores from other cohorts with various eye diseases. On most subscales, the patients with MacTel type 2 had scores that ranked within one, two, or three steps from the worst score. This may be because MacTel type 2 is one of the few clinical retinal diagnoses in which visual impairment is usually present in both eyes and thus reflects a reduced vision-related quality of life.

Discussion

This report provides the first data regarding vision-targeted HR-QOL collected using a standard instrument for patients with MacTel type 2. Significant correlation coefficients were found between most of the NEI-VFQ-25 subscale scores and visual acuity. It was also shown that the NEI-VFQ-25 showed moderately strong internal consistency within the MacTel cohort. This demonstrates that the NEI-VFQ-25 is sensitive to the effect of MacTel type 2 and supports the construct validity of the questionnaire. Further evidence of the validity of the questionnaire within this cohort is provided by the decrease in the overall score and several subscale scores with the progressive degrees of visual impairment. Vision-targeted HR-QOL mean subscale scores assessed with the NEI-VFQ-25 were lower compared with the reference group free from eye disease. Furthermore, compared with other cohorts with AMD and diabetic retinopathy, the MacTel cohort showed lower mean scores for most subscales and ranked among the lowest scores across other cohorts with various eye diseases. This result is consistent with the impression of study investigators that MacTel type 2 has a significant impact on visual functioning, in particular vision-targeted HR-QOL, even when visual acuity is only modestly impaired. A plausible explanation for this is that the most markedly affected region of the macula is not the fovea, but rather the inferotemporal perifoveal zone.[25]

The results of this study confirm results in previous studies of cohorts with eye disease that showed the influence of visual function on vision-targeted HR-QOL.[8,9,11,12,15,18] However, relationships between mean NEI-VFQ-25 scores and demographics in the MacTel cohort revealed some results not demonstrated in other studies–for example, the linear relationship between the MacTel cohort's age and NEI-VFQ-25 mean scores. Age was not associated with previous treatment or whether the disease was the proliferative type (data not shown). A significantly higher percentage of men were in the older age group and had higher scores than did the women. This difference may be one explanation for the higher scores in the older cohort, yet it is important to note that the linear relationship between MacTel cohort's age and NEI-VFQ-25 mean scores remained after adjustment for sex and other covariates. Previous studies have reported lower scores in older individuals than in younger ones.[11,14,26]

The previous studies consisted of participants with age-related macular degeneration and type I diabetes and had similar proportions of women. All mean subscale scores except for color vision were higher in the AMD and diabetes cohorts than in participants with MacTel type 2. Participants with MacTel type 2 were on average younger but had a lower mean visual acuity in both the better and worse eye than did the AMD cohort. Correlations between visual acuity and subscale scores were lower in the MacTel cohort than were correlations found in the other studies.

The mean overall NEI-VFQ-25 score was found to be significantly higher in the men than in the women with MacTel type 2. Other studies have found no differences in the overall composite mean score among the men and the women.[11,14,26] As mentioned previously, participants with MacTel type 2 were enrolled from seven countries, another difference from

other studies reporting NEI-VFQ-25 results in participants with eye diseases. The studies we looked at enrolled only participants from a single country or region.[8,9,11,12,15,18,26]

This study has some limitations. We did not compare the results with a similarly collected control group, because the objective of this MacTel Project is to evaluate the clinical features and natural history of the disease in patients with MacTel type 2. Although differences in the normal control subjects and our cohort may have an influence on the results, we believe this unlikely given the large differences found between our cohort and the field test reference group. It is important to note that the ranking of MacTel type 2 NEI-VFQ-25 scores in Table 5 compared with other ocular conditions did not take into account known and unknown confounders. Therefore, some caution should be used in interpreting the relative rankings.

In summary, these results show that MacTel type 2 is associated with significant reductions in vision-targeted HR-QOL and may also signify that these reductions are more severe than in cohorts with other eye diseases with similar levels of visual acuity. This study confirms clinical observations from the MacTel Project that MacTel type 2 has a significant effect on vision-specific HR-QOL.

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Appendix: The MacTel Research Group

Centre Hospitalier National d'Ophtalmologie des Quinze-Vingts (*Paris*, *France*): Jose-Alain Sahel, Jean-Francois Girmens, and Saddek Mohand-Said.

Centre for Eye Research (*Melbourne*, *Australia*): Robyn Guymer, Rebecca Maxwell, Khin Z. Aung, Lisa Breayley, Rebecca Davies, Andrew Newton, and Richard Smallwood.

Clinique Ophthalmolgie de Creteil (*Creteil*, *France*): Gisele Soubrane, Karim Atmani, Aline Kunsch, Marc Lasnier, Vincent Parier, and Helene Poussard.

Hôpital Lariboisiere (*Paris*, *France*): Alain Gaudric, Valerie Krivosic, Salomon Cohen, Ali Erginay, and Pascale Massin.

Jules Stein Eye Institute, *University of California* (*Los Angeles*, *CA*): Steven Schwartz, Juewon Khwarg, Christine Gonzales, Anurag Gupta, Rosaleen Ostrick, and Malou Rosman.

Lions Eye Institute (*Perth*, *Australia*): Ian Constable, Milada Zlatnik, Chris Barry, Joanne Cerruti, Max Cuypers, Tim Isaacs, Ian McAllister, Esperan Pather, Frank Shilton, and Lynne Smithies.

Manhattan Eye, Ear, and Throat Hospital (*New York*, *NY*): Michael J. Cooney, Michelle Cimino, Eugene Agresta, K. Bailey Freund, Namrata Saroj, Nancy Gonzalez, and Lawrence Yannuzi.

Moorfields Eye Hospital (*London*, *UK*): Cathy Egan, Sally Falk, Rebecca Black, Andrew C. Browning, Mina Devani-Gokaldas, Hannah Dunbar, Felicia Ikeji, Richard Poynter, Matthew Richardson, and Sonal Rughani.

Retina Associates of Cleveland (*Cleveland*, *OH*): Lawrence Singerman, Stephanie Schura, John DuBois, Gregg Greanoff, David Miller, and Scott Pendergast.

Save Sight Institute (*Sydney, Australia*): Mark Gillies, Meidong Zhu, Haipha Ali, Nicky Cunningham, Christine Gaston, Grace Hunt, and Maria Williams.

Scripps Research Institute (*La Jolla, CA*): Martin Friedlander, Jennifer Trombley, and Martin Cervantes.

St. Franziskus Hospital (*Münster, Germany*): Daniel Pauleikhoff, Bjorn Padge, Britta Heimes, Andreas Henschel, Kristina Kazior, George Spital, and Meike Trieschmann.

The Goldschleger Eye Institute (*Tel-Hashomer, Israel*): Joseph Moisseiev, Vicky Dai, Nirit Atias, Zvi Friedman, Irit Hadas, Inesa Kelener, and Iris Moroz.

The New York Eye and Ear Infirmary (*New York, NY*): Richard Rosen, Anita Ou, Kenneth Boyd, Ronald Gentile, Robert Masini, Juan Romero, Katy Tai, and Paul Whitten.

The Retina Group of Washington (*Fairfax, VA*; *Chevy Chase, MD*): Robert Murphy, Lisa Byank, Debbie Oliver, Aida Ayyad, Courtney Dunn, Mike Flory, and Robert Frantz.

University of Bonn (*Germany*): Frank Holz, Peter Charbel Issa, Boris Airo, Kerstin Bartsch, Robert Finger, Susanne Hinzmann, Cevriye Kocyigit, Rana Lee-Scholer, Hendrik Scholl, and Gero Tietz.

University of Michigan, Kellogg Eye Center (*Ann Arbor, MI*): Andrew Vine, Pam Titus, Richard Hackel, Robert Prusak, and Tom Zbeda.

University of Wisconsin (*Madison, WI*): Barbara Blodi, Michelle Olson, Justin Gottlieb, Gene Knutson, Denise Krolnik, and John Peterson.

The Wilmer Eye Institute, The Johns Hopkins University (*Baltimore, MD*): Diana Do, Lisa Greer, Judy Belt, Dennis Cain, David Emmert, Janis Graul, Julia Haller, Jackie MacDonald, and Jennifer Simmons.

Scheie Eye Institute, University of Pennsylvania (*Philadelphia, PA*): Alexander J. Brucker, Sheri Grand Drossner, Jim Berger, Cheryl Devine, Joshua L. Dunaief, Joan DuPont, Albert Mahler MaGuier, Bill Nyberg, and Laurel Weeney.

L. V. Prasad Eye Institute (*Hyderabad, India*): Raja Narayanan, Savitha Viswanathan, Vibha Choudhary, Taraprasad Das, and G. Muneeshwar Gupta.

Coordinating Center, The EMMES Corporation (*Rockville, MD*): Traci E. Clemons, Maria Figueroa, Traci Scheer, Trudy Chandler, Molly Harrington, Michael Frasketi, Glenn Tucker, and Lisa Greene.

Moorfields Eye Hospital Reading Center (*London, UK*): Tunde Peto, Richard Seeberan.

Columbia University Eye Research Institute (*New York, NY*): Rando Allikmets, Smitha Gopakumar.

Executive Committee Members: Mark Gillies, *Save Sight Institute* (*Sydney, Australia*); Alan C. Bird, *Moorfields Eye Hospital* (*London, UK*); Emily Y. Chew, *National Eye Institute/ National Institutes of Health* (*Bethesda, MD*); Marty Friedlander, *Scripps Research Institute* (*La Jolla, CA*); Robert M. Graham, *Victor Chang Cardiac Research Institute* (*Sydney, Australia*): Stephen Johns, *Westfield Group Limited* (*Sydney, Australia*); and Frank Lowy, Stephen Lowy, and Frank Martin, *The Lowy Medical Research Institute Limited* (*Sydney, Australia*).

Laboratory Science Group: Marty Friedlander, *Scripps Research Institute* (*La Jolla, CA*); Rando Allikmets, *Columbia University* (*New York, NY*); Marcus Fruttiger, John Greenwood, and Steven Moss, *University College London*, *Institute of Ophthalmology* (*London, UK*); Mark Gillies, *Save Sight Institute* (*Sydney*, *Australia*); and Lois E. H. Smith, *Harvard Medical School, Children's Hospital* (*Boston*, *MA*).

Oversight Committee: Brad Straatsma, Dean Bok, David Geffen School of Medicine University of California (*Los Angeles*, *CA*); Marie Diener-West, *The Johns Hopkins University*, *Bloomberg School of Public Health* (*Baltimore, MD*); Stuart L. Fine, *Scheie Eye Institute*, *University of Pennsylvania* (*Philadelphia*, *PA*); and Larry Sherman, *Oregon National Primate Research Center*, *Division of Neuroscience* (*Beaverton*, *OR*).

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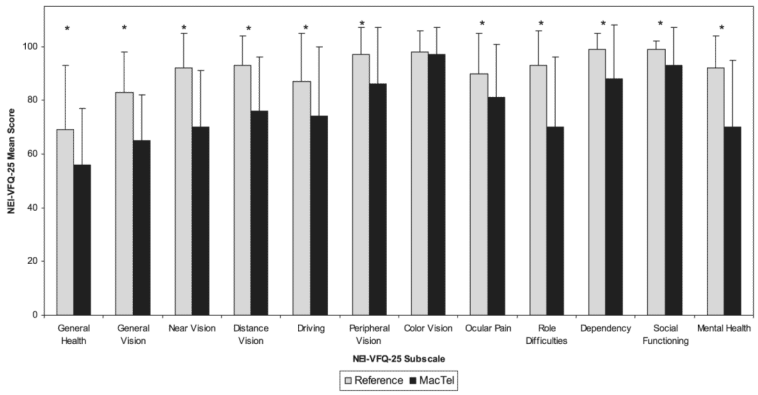

Figure 1.
Comparison of NEI-VFQ-25 Subscale Means (Reference group versus MacTel Cohort). * Two tailed *t*-test $P < 0.0001$.

Table 1

Natural History Study Participant Characteristics

Participants, *n* (%)	222 (100)
Age (y)	
Mean (SD) y, *n* (%)	61 (9)
<55	47 (22)
55–59	45 (20)
60–64	44 (20)
65–69	50 (23)
≥70	36 (16)
Female, *n* (%)	134 (60)
Caucasian, *n* (%)	188 (88)
Proliferative disease, *n* (%)*	28 (13)
Received treatment for MacTel type 2, *n* (%)	51 (23)
Duration of disease, mean years (SD)	3.7 (4.3)
Visual acuity score of better eye, mean (SD)	75 (11)
Visual acuity score of worse eye, mean (SD)	61 (17)
Visual acuity category	
Both eyes 20/32 or better, *n* (%)	50 (23)
One eye worse than 20/32, *n* (%)	84 (38)
Both eyes worse than 20/32, *n* (%)	88 (40)

*Missing and/or ungradeable fundus photographs and/or OCTs for 13 participants.

Table 2

NEI-VFQ-25 Results in Patients with MacTel Type 2

NEI-VFQ-25 Subscale	Mean ± SD	Median	Cronbach's α*	Ceiling *n* (%)	Floor *n* (%)
General health	56 ± 21	50	N/A†	18 (8)	3 (1)
General vision	65 ± 17	60	N/A†	7 (3)	0 (0)
Ocular pain	81 ± 20	88	0.66	85 (38)	0 (0)
Near activities	70 ± 21	75	0.75	24 (11)	0 (0)
Distance activities	76 ± 20	83	0.70	36 (17)	0 (0)
Social functioning	93 ± 14	100	0.70	164 (74)	0 (0)
Mental health	70 ± 25	75	0.75	19 (9)	1 (<1)
Role difficulties	70 ± 26	75	0.74	52 (23)	6 (3)
Dependency	88 ± 20	100	0.79	134 (60)	1 (<1)
Driving‡	74 ± 26	88	0.48	41 (18)	9 (4)
Color vision	97 ± 10	100	N/A†	201 (91)	0 (0)
Peripheral vision	86 ± 21	100	N/A†	140 (63)	0 (0)
NEI-VFQ-25 (overall)	77 ± 13	80	0.90	1 (<1)	0 (0)

*Standardized Cronbach's α.

†NA, correlations are not applicable because only one item in the subscale.

‡43 participants did not drive due to reasons other than eyesight.

Table 3

Correlations between Visual Acuity and NEI-VFQ-25 Subscales

	Visual Acuity	
NEI-VFQ-25 Subscale	**Better Eye**	**Worse Eye**
General health	0.20*	0.19
General vision	0.34*	0.33*
Ocular pain	0.05	0.04
Near activities	0.38*	0.32*
Distance activities	0.32*	0.27*
Social functioning	0.24*	0.18*
Mental health	0.15	0.16
Role difficulties	0.24*	0.22*
Dependency	0.23*	0.25*
Driving	0.32*	0.27*
Color vision	0.20*	0.14
Peripheral vision	0.29*	0.32*
NEI-VFQ-25 (overall)	0.37*	0.34*

*Significantly different from 0, $P < 0.01$.

Table 4

Adjusted NEI-VFQ-25 Subscale Scores by Visual Acuity Group*

NEI-VFQ-25 Subscales	20/32 or Better in Both Eyes	Worse Than 20/32 in One Eye	Worse Than 20/32 in Both Eyes	*P* for Linear Trend
General health	68 (4.0)	58 (3.4)	57 (3.3)	<0.01
General vision	63 (2.9)	62 (2.4)	53 (2.4)†	<0.01
Ocular pain	78 (3.7)	82 (3.2)	80 (3.1)	0.75
Near activities	72 (3.6)	68 (3.0)	58 (2.9)†	<0.01
Distance activities	73 (3.5)	71 (2.9)	64 (2.8)	0.01
Social functioning	88 (2.5)	88 (2.1)	82 (2.1)	0.02
Mental health	66 (4.3)	65 (3.6)	57 (3.5)	0.04
Role difficulties	67 (4.6)	67 (3.9)	57 (3.8)	0.03
Dependency	90 (3.6)	86 (3.1)	79 (3.0)†	<0.01
Driving	77 (4.6)	75 (4.0)	58 (4.1)†	<0.01
Color vision	97 (1.9)	94 (1.6)	94 (1.5)	0.08
Peripheral vision	87 (3.9)	82 (3.3)	78 (3.2)	0.02
NEI-VFQ-25 (overall)	77 (2.3)	75 (1.9)	69 (1.9)†	<0.01

*Data are the mean (SE) scores adjusted for age, sex, race and disease type.

†Mean the difference from “20/32 or better in both eyes” group significant at $P < 0.01$ using the Dunnett multiple comparison test.

Table 5

Comparisons of Mean NEI-VFQ-25 Scores of MacTel Type 2 Patients with Other Ocular Disease Cohorts

NEI-VFQ-25 Subscales	MacTel Type 2 Patients	Other Ophthalmology Patients*								MacTel Type 2 Ranking†
		A	B	C	D	E	F	G	H	
General health	56	72	71	65	46	62	55	45	74	4
General vision	65	79	79	53	62	71	60	76	84	4
Ocular pain	81	87	89	87	88	89	86	90	70	2
Near activities	70	90	85	54	63	79	73	84	86	3
Distance activities	76	89	86	56	66	77	73	84	89	4
Social functioning	93	97	97	73	81	89	87	96	97	5
Mental health	70	85	85	58	66	81	77	74	88	3
Role difficulties	70	89	87	61	69	84	76	78	86	3
Dependency	88	97	97	72	77	92	88	89	98	3
Driving	74	84	85	39	55	75	63	80	86	4
Color vision	97	95	95	85	90	93	90	98	97	7
Peripheral vision	86	89	93	77	78	76	87	78	94	5
Participants, *n*	222	244	1052	108	123	77	93	37	75	
Mean age, *y*	61	40	71	76	62	67	73	39	46‡	
% Female	60	79	61	63	66	54	66	5	71	
Median visual acuity in better eye§	32	<20	20	63	40	25	40	20	N/A	

*A, patients treated for acute optic neuritis in the Optic Neuritis Treatment Trial (Cole et al.15); B, patients with signs of high risk, early AMD, and relative good visual acuity in each eye enrolled in the Complications of Age-Related Macular Degeneration Prevention Trial (The CAPT Research Group12); C, patients in the NEI-VFQ Field Test Study who had AMD (Mangione et al.7,8); D, patients in the NEI-VFQ Field Test Study who had diabetic retinopathy (Mangione et al.7,8); E, patients in the NEI-VFQ Field Test Study who had glaucoma (Mangione et al.7,8); F, patients in the NEI-VFQ Field Test Study who had preoperative age-related cataract (Mangione et al.7,8); G, patients in the NEI-VFQ Field Test Study who had cytomegalovirus retinitis (Mangione et al.7,8); H, patients with dry eye (Nichols18).

†Ranking by worse subscale score.

‡Median age, years.

§Data are given as 20/*x* where *x* is the Snellen fraction denominator.