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A Study of the Natural History of Vitreomacular Traction Syndrome by OCT

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Purpose: To examine the natural history of vitreomacular traction syndrome (VMTS) in the absence of other ocular comorbidities.

Design: Retrospective clinical case series.

Participants: A total of 183 eyes of 159 patients diagnosed with VMTS with no other ocular comorbidity.

Methods: Patients with VMTS were identified from an OCT database at Moorfields Eye Hospital, London. Sequential OCT scans and patient notes were reviewed over a minimum period of 6 months. Data collected included patient demographics, best-corrected visual acuity, and OCT features of vitreomacular adhesion. Contingency tests and binary logistic modeling were used to identify baseline predictors of stability and progression.

Main Outcome Measures: The rates of spontaneous resolution (defined by release of traction), progression to full-thickness macular hole, and surgical intervention were analyzed.

Results: Presenting visual acuity was 0.3±0.3 logMAR units. The mean length of follow-up was 17.4±12.1 months. During this period, VMTS persisted in 60% and resolved in 20% (occurring on average at 15 months). Of the remainder, 12% developed a macular hole and 8% elected to proceed with surgery for symptoms. Focal adhesion <1500 μm was present in 87%. A premacular membrane with macular pucker (PMM) was present in 20%. With persistent VMTS, vision and central foveal thickness remained unchanged. The relative risk of resolution increased in those cases with better presenting visual acuities, lesser foveal thicknesses, and no associated PMMs; vision significantly improved in those cases with resolution.

Conclusions: VMTS persists in the majority of patients but despite this, visual acuities did not deteriorate significantly over the study period unless patients developed a full-thickness macular hole or required surgical intervention for symptoms. Resolution spontaneously occurred in 20%, with an improvement in vision. *Ophthalmology 2017;■:1–7 Crown Copyright © 2017 Published by Elsevier Inc. on behalf of the American Academy of Ophthalmology*

Vitreomacular traction syndrome (VMTS) forms part of a spectrum of diseases with abnormal vitreomacular adhesion. This condition was initially thought to be relatively uncommon, as only gross cases were identified by clinical examination. The development of OCT led to an increase in its diagnosis and revived interest in VMTS.

VMTS is characterized by anomalous posterior vitreous detachment (PVD) accompanied by anatomic distortion of the fovea. This may include the presence of pseudocysts, macular schisis, cystoid macular edema, and subretinal fluid. Clinically, symptoms can vary from none to distortion and/or reduced visual acuity. In some cases visual acuity may progressively deteriorate, resulting in vision of 20/200 (1.0 logarithm of the minimum angle of resolution [logMAR]) or less.[1] This may also be accompanied by macular hole formation.

The International Vitreomacular Traction Study (IVMTS) Group recently developed a classification system that aids in the characterization of this abnormal interaction between the vitreous and macula.[2] In so doing, this system has allowed more consistent reporting of vitreomacular interface disorders.

There is a paucity of natural history data relating to VMTS within the published literature. Controversy exists regarding the exact rate of spontaneous resolution in eyes with VMTS. Some reports suggest that the rate of spontaneous PVD in this condition is uncommon, with Hikichi et al[1] reporting a PVD rate of 11% over a 5-year period; other authors have observed a higher rate of approximately 50% in a follow-up of around 9 months.[3,4] To further confound this issue of resolution, Reibaldi et al[5] highlight a case with a 10-year history of nonresolving severe VMTS with no resultant anatomical or functional damage.

The limited natural history data is surprising, given that therapeutic interventions are offered to patients with VMTS, including vitrectomy and, more recently, enzymatic vitreolysis.[6] In cases where spontaneous resolution of VMTS fails to occur, vitrectomy may be offered to patients who report symptoms of reduced vision and/or distortion.[7] Knowledge of the rate of spontaneous improvement is important for patients making the decision regarding surgery, as well as for providing doctors with sufficient information for informed consent. Following the advent of

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intravitreal injections of gas or pharmacologic agents such as ocriplasmin to induce vitreolysis, cases of mild yet symptomatic VMTS are now considered for intervention.[6,8] This further supports the need for more robust natural history data.

This study describes the natural history of VMTS over a minimum period of 6 months. To our knowledge, this large series differs from others because it concerns VMTS in the absence of other ocular comorbidities and utilizes an independent accredited OCT grader to assess OCT features of VMTS, with a follow-up of more than 6 months.

Methods

This retrospective cohort study was approved by the local ethics review board committee and adhered to the tenets set forth in the Declaration of Helsinki. A total of 183 eyes in 159 patients with a diagnosis of VMTS were identified from a database containing all patients imaged with OCT between 2009 and 2011 at Moorfields Eye Hospital, London, United Kingdom. The inclusion criterion was the presence of vitreomacular traction on OCT, as defined by the IVMTS Group: evidence of perifoveal vitreous cortex detachment from the retinal surface; macular attachment of the vitreous cortex within a 3-mm radius of the fovea; and association of the attachment with distortion of the foveal surface, intraretinal structural changes, elevation of the fovea above the retinal pigment epithelium, or a combination thereof, but no full-thickness interruption of all retinal layers.[2] Cases with lamellar macular holes were excluded from this study. All patients had a minimum follow-up period of 6 months, unless there was either resolution, progression to a full-thickness macular hole, or surgery for symptoms. Exclusion criteria included coexisting retinal disease, previous history of retinal detachment, ocular inflammation, and proliferative retinal disease.

The IVMTS Group grading system classifies VMTS into focal ($<$1500 μm) or broad ($\geq$1500 μm) groups depending on maximal horizontal surface adhesion.[2] To complement this, we utilized a system described by John et al[9] to catalog the intraretinal OCT findings at presentation (Fig 1). Here, grade 1 is defined as incomplete cortical vitreous separation with foveal attachment; the additional presence of intraretinal cysts/clefts denotes grade 2; and in grade 3 a foveal photoreceptor detachment is also present.[9]

The following data were collected for each patient at the time of inclusion: demographics, best-corrected visual acuity, and OCT features of VMTS, including macular thickness, maximal horizontal surface adhesion, and intraretinal changes. Imaging was performed with either Topcon 3D-OCT (Topcon, Tokyo, Japan) or Spectralis OCT (Heidelberg Engineering, Heidelberg, Germany). For the Topcon 3D-OCT, a macular volume scan was performed for each eye consisting of 128 horizontal B-scans, centered through the fovea. For the Spectralis OCT, a similar horizontal raster scan was performed, centered on the fovea and covering a 6×6-mm^2 area. Patients underwent a series of OCT scans spanning a period of more than 6 months. All OCT scans were graded, then validated by a single, reading center–certified OCT grader masked to all clinical information at the time of grading.

The rate of spontaneous PVD, as defined by resolution of traction and improvement of anatomic distortion of the fovea, was documented. Over the study period some patients elected to have surgery. Surgery in this unit was offered for progression to macular hole or for symptoms of significant distortion and/or reduction of vision present with both eyes open. The Snellen visual acuity was documented at the final follow-up visit.

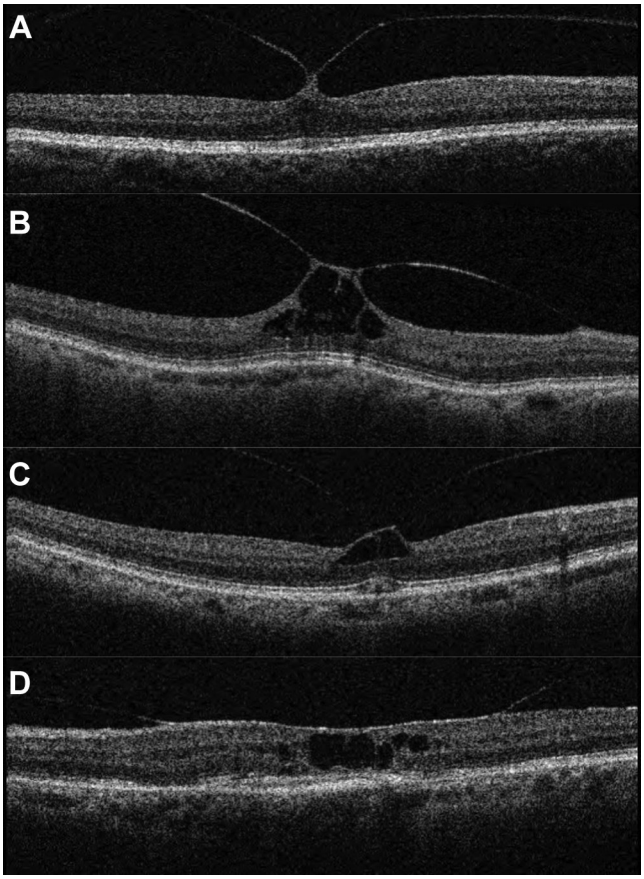

Figure 1. Retinal OCT scans depicting the grading reported by John et al[9] of retinal architecture in vitreomacular traction syndrome: (**A**) grade 1 vs. (**B**) grade 2 vs. (**C**) grade 3. **D**, An example of a broad adhesion subtype of the International Vitreomacular Traction Study group subtypes.

Data Analysis and Statistical Methods

Data were analyzed with descriptive and frequency statistics. Snellen visual acuities were converted to logMAR units for analysis. The application of parametric and nonparametric tests was dependent on normality, as determined using the D'Agostino and Pearson test. The statistical distribution of groups was compared using the unpaired *t* test (2-tailed), Mann-Whitney test (2-tailed), and Kruskal-Wallis test (for comparison of more than 2 groups). The Wilcoxon test was used to compare paired groups and the chi-square test was used to compare categorical variables. The relative risk was used to calculate the strength of association between categorical variables, as the prevalence of VMTS is less than 10%.[10] A P value less than 0.05 was considered statistically significant. In graphs, the error bars depict standard deviation. Binary logistic regression models for different outcomes were fit with potential baseline predictors: age, visual acuity, gender, grade, adhesion, premacular membrane with associated macular pucker (PMM), and foveal thickness. The former 2 variables are continuous data and the remainder are nominal data. Models were refined using a stepwise backward elimination of nonsignificant ($P \geq 0.05$) variables. A P value greater than 0.05 was used to confirm the validity of the model using the "goodness-of-fit" tests. Statistical analysis was performed using Minitab 16 (Minitab Inc., State College, PA) and Prism 6.0 (GraphPad Software Inc., La Jolla, CA).