Combined nutritional keratoconjunctivitis sicca and optic neuropathy due to restrictive
dietary multivitamin deficiency of vitamin C and B12 during the COVID19 pandemic

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The severe acute respiratory virus syndrome coronavirus 2 (SARS-CoV2) disease of 2019 (COVID-19) pandemic and subsequent shutdowns resulted in significant changes to dietary habits. Quarantined populations reported consuming fewer fresh vegetables, fruits, and legumes.\(^1\) Associated psychosocial stressors have resulted in increased alcohol consumption and smoking.\(^1\) COVID-19 lockdowns have impacted the way Americans order groceries (e.g., on-line) and pre-prepared food (e.g., take-out and delivery).\(^2\) Many have chosen grocery delivery or curbside pickup services, with unknown nutritional implications.\(^2\)

Vitamin B12 is a cofactor for methionine synthase and methylmalonyl-CoA mutase that is found in animal products and is important for the myelination of neurons. B12 deficiency may produce spinal cord and optic nerve demyelination. This may present with painless, progressive, bilateral loss of visual acuity (VA), color vision, and central or cecocentral visual field loss.\(^3\)

In contrast, vitamin C (ascorbic acid) is found in fruits and vegetables and has important roles in collagen production and antioxidation. Vitamin C deficiency may present with bruising and poor wound healing. Severe deficiencies of vitamin C (i.e., ocular “scurvy”) in the modern era is extremely rare, but typical findings include subconjunctival hemorrhages, keratitis, and episcleritis.

We present a case of severe nutritional keratoconjunctivitis sicca and optic neuropathy due to presumed combined vitamin C and vitamin B12 deficiency resulting from COVID-19 associated restriction of diet. To our knowledge, this is the first such case reported in the English language ophthalmic literature.

A 62-year-old female presented with painless, progressive vision loss, severe dry eyes, and marked light sensitivity in both eyes (OU) for approximately 11 months at the height of the COVID-19 pandemic in the United States. Past medical history included breast carcinoma status post resection without metastatic or recurrent disease. She reported
consuming 3 standard alcoholic drinks and half a pack of cigarettes per day. Surgical history included cataract extraction OU. Family history was non-contributory. Her medications only included topical artificial tears and ointments, with a history of tamoxifen for five years.

Over the past year (2020), she reported decreased appetite and unintentional weight loss of 7 pounds. Due to the COVID-19 shutdown, she had a significant decrease in consumption of fruits and vegetables. The patient was dissatisfied with the grocery store’s designated shoppers and their ability to select the proper produce items that she had ordered online and so she stopped ordering.

She was initially seen by two ophthalmologists and diagnosed with severe keratoconjunctivitis sicca, without improvement despite aggressive topical prednisone and artificial tear and ointment lubricating regimens. The patient’s symptoms worsened, and she developed loss of central vision initially attributed to severe corneal dryness. A third ophthalmologist ordered magnetic resonance imaging (MRI) of the brain and orbits with and without contrast, which was normal. The patient was then referred to neuro-ophthalmology.

Initial examination revealed 20/400 VA in the right eye (OD) and count fingers at 4 feet in the left eye (OS). No relative afferent pupillary defect was noted. Intraocular pressure measurements, external exam, and motility examinations were normal OU. Slit lamp exam revealed moderate conjunctival injection OU, absence of conjunctival Bitot spots, and diffuse punctate epithelial erosions (PEE) of both corneas consistent with keratoconjunctivitis sicca. No tamoxifen retinopathy was seen on fundus examination. There was no optic disc edema, but infrared photograph demonstrated nonspecific retinal pigment epithelium (RPE) change and peripapillary atrophy OU. Humphrey visual field (HVF) 24-2 showed dense central scotoma OS (Figure 1a) with foveal threshold of <0dB OU. Optical coherence tomography (OCT) of the optic nerve retinal nerve fiber layer (RNFL) demonstrated papillomacular
bundle dropout corresponding to the central scotomas OU (Figure 2). Physical exam revealed no peripheral neuropathy, gingival bleeding, or nail findings.  

Bloodwork revealed serum vitamin B12 was low at 327 pg/mL (normal > 400) with elevated homocysteine levels of 18.5 µmol/L (normal <15) and markedly low vitamin C level of < 0.1 mg/dL (normal > 0.4). Methylmalonic acid (MMA), folate, and vitamins A, D, and E were within normal limits. The patient’s hemoglobin was low-normal at 12.2 g/dL with a low red blood cell count of 3.65 million/µL. The patient was advised to discontinue alcohol and tobacco use and subsequently began aggressive multivitamin supplementation.  

At 2.5 months follow-up her diet had improved, and she had markedly better vision with almost complete resolution of dry eye symptoms. VA improved to 20/200 OD and 20/160 OS. Repeat labs demonstrated improved serum B12 of 475 pg/mL and normalized vitamin C levels of 1.7 mg/dL. Repeat HVF revealed improved central scotomas but residual left inferior nasal step (Figure 1b) and improved foveal thresholds of 28 decibels (dB) OD and 33 dB OS. She reported an increased intake of fresh fruits, vegetables, and meat products in addition to a daily multivitamin. She reduced her alcohol consumption from 3 cocktails a day to 2-3 per week and cut her daily smoking in half. At a visit 8 months following initial presentation, her VA had improved to 20/40 OU.  

Nutritional optic neuropathy from inadequate dietary intake of B12 and B9 is uncommon in developed countries. Alcohol abuse, gastrointestinal surgeries, and intentionally restrictive diets can produce vitamin deficiency. Our patient’s initial presentation of severe keratoconjunctivitis sicca due to concomitant vitamin C deficiency in the setting of toxic-nutritional optic neuropathy is interesting and unique.  

Our patient had additional risk factors for toxic/nutritional optic neuropathy including alcohol and tobacco use. Patients with a history of alcohol abuse may exhibit poor dietary intake, with chronic intestinal irritation and decreased liver function further reducing vitamin
Tobacco use alone may also produce optic neuropathy, as vitamin B12 is an important co-factor in the detoxification of cyanide, a known component of cigarette smoke. Keratoconjunctivitis sicca is a known presentation of vitamin C deficiency. In a 1970 study, five men were deprived of vitamin C and three developed dry, light sensitive eyes. Subsequent vitamin C supplementation resolved their symptoms. Increased oxidative damage by reactive oxygen species (ROS) in the inflammatory cascade is a likely contributory mechanism.

Clinicians should be aware that indirect effects of the COVID-19 pandemic including quarantine related dietary restriction may cause ocular morbidity, as nutritional optic neuropathy epidemics have occurred in recent history. Concomitant vitamin C and vitamin B12 deficiency may present as severe keratoconjunctivitis sicca and nutritional optic neuropathy. To our knowledge, this is the first such case induced by dietary restriction to be described in the English language ophthalmic literature.
References


Figure Legends:

Figure 1a: HVF prior to vitamin supplementation and lifestyle changes

Figure 1b: HVF after vitamin supplementation and lifestyle changes
Figure 2: Initial OCT
Statement of Authorship

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