

# Is Acute Solid Food Aversion a Proxy for COVID-19–Related Olfactory and Gustatory Dysfunction?

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Olfactory and gustatory dysfunction (OGD) may be observed in adult and pediatric patients with coronavirus disease 2019 (COVID-19). In young preverbal patients, the presence of OGD may go undetected. We describe 2 children <2 years of age with acute solid food aversion most likely as a manifestation of OGD immediately after COVID-19 infection, with slow to minimal improvement over 6 to 8 months in both children. A review of the literature on COVID-19–related OGD in children is presented, revealing <100 cases and none associated with documented food aversion. We believe the presence of acute food aversion in preverbal children, in the appropriate epidemiological and clinical context, should trigger testing for COVID-19 because it may be the first and only symptom of infection and for pediatricians to provide anticipatory guidance for parents after acute COVID-19 infection in young children.

The association of olfactory and gustatory dysfunction (OGD) with coronavirus disease 2019 (COVID-19) is well established. A recent meta-analysis including >100 publications reported a prevalence of anosmia or dysgeusia (OGD) of ~38% and 37%, respectively.<sup>1</sup> OGD has also been described in children, but no summary data are available. The youngest child reported with COVID-19–associated OGD is >6 years of age.<sup>2</sup> In nearly all cases, OGD is identified via self-report because objective measurement tools for detection of taste and smell abnormalities are rarely available in the clinical setting. Diagnosis in the young nonverbal population is, therefore, challenging. We report 2 children <2 years of age who presented with acute solid food aversion likely as a manifestation of OGD from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. We also provide a summary of all reported cases of OGD in children with COVID-19.

## CASE REPORT AND REVIEW OF LITERATURE

### Case 1

A 16-month-old girl presented to Harbor-UCLA Medical Center in mid-April 2021 after her mother witnessed 15 seconds of no breathing and perioral cyanosis that self-resolved. This occurred after a choking episode while drinking. Four months before admission (December 2020), the patient had a few days of low-grade fever, increased fussiness, and decreased oral intake. She tested positive for SARS-CoV-2 on reverse transcription-polymerase chain reaction (RT-PCR) testing from a nasal swab sample (influenza virus A and B were negative). Since then, she refused to eat solid foods and only drank large volumes of whole milk, up to 1 and a half-liters per day. She was admitted for observation and further evaluation for solid food refusal.

Before her COVID-19 diagnosis, solid food was introduced at 6 months of

## abstract

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Dr Tseng conceptualized the report, collected and analyzed clinical details of case patients, wrote the initial manuscript, and reviewed and revised the manuscript; Drs Zangwill and Yeh conceptualized the report, analyzed and interpreted clinical data, and critically reviewed and revised the manuscript; Dr Basiago and Ms Miyares are the primary care providers for the patients, identified the cases for review, interpreted clinical data, and critically reviewed and contributed to the manuscript; and all authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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age with normal intake of a variety of foods. She was born at term with an uncomplicated birth history. Her immunizations were up-to-date, and she had been previously healthy. The patient has always lived with her 42-year-old mother and her 11- and 22-year-old brothers in a relative's garage with 10 other people in the house. Mom receives support from outpatient social workers, and the patient has always had an adequate food supply. The family had not experienced any major socioeconomic changes. Since her diagnosis 4 months ago (December 2020), however, she chews food, but then vomits with gagging in 90% of the feedings. Mother denied any previous choking, foreign body aspiration, or other known traumatic events before the onset of her change in eating habits. In addition to solid food aversion, the child would gag and subsequently rub her nose and eyes after exposure to fragrances from perfumes, shampoos, soaps, lotions, and toothpastes. Before her COVID-19 illness, she spoke 7 words, but now uses only 1 word. Other than the speech regression, she met age-specific milestones for all other areas of development.

On admission, her vital signs and physical examination were normal. Compared with records at our institution, she did not have any recent weight loss and was growing along the 90th percentile curve for weight, 15th percentile curve for height, and 80th percentile curve for head circumference. Laboratory tests revealed the following: white blood cell count of  $16\,600/\text{mm}^3$ , hemoglobin of 14.1 g/dL, platelet count of  $492\,000/\text{mm}^3$ , bicarbonate of 20mmol/L, anion gap of 13, aspartate aminotransferase of 42 U/L, and lead level of  $<2\ \mu\text{g}/\text{dL}$ . SARS-CoV-2 RT-PCR on this admission was negative, and also negative for 21 other organisms included in the

BioFire Respiratory Panel. Radiography of the abdomen and chest revealed only moderate stool burden. Abdominal ultrasound did not reveal evidence of intussusception, and electrocardiogram was normal.

Her hospital course involved consultation by occupational therapy and gastroenterology. The patient refused pureed foods and would only drink fluids. Because of the moderate stool burden on imaging, she underwent bowel clean out with glycerin enema and polyethylene glycol delivered via nasogastric tube. She stooled and, after reattempting to offer puree, the patient refused again. Mechanical chewing ability was assessed as normal. It was not felt that a stricture or other specific etiology explained her acute solid food aversion. The option of an outpatient swallowing study was discussed with the mother, but, after shared decision-making, further studies were not performed. She was discharged on hospital day 2.

The patient was contacted a week after discharge by the primary care provider and a month later by the nutritionist. She continued to be sensitive to fragrances but was eating 1 to 2 full spoons of solid food per meal and  $\sim 800$  mL of milk per day. Twice daily supplemental PediaSure was recommended along with a solid and pureed diet at each meal to increase solid food acceptance. Feeding continued to be suboptimal and the child was referred to a feeding program. The patient was seen 8 months after COVID-19 infection, at which time her weight was at the 99th percentile; she continued to refuse solid food. She was not saying her sole word. As of August 2021, she had completed speech and occupational therapy evaluations and was deemed qualified for intervention. She is currently waiting on these services that are

delayed due to patient visitation limitations during the pandemic.

## Case 2

In January 2021, a 17-month-old boy, born at 34 weeks' gestation with an uncomplicated NICU course, developed fever, rhinorrhea, shortness of breath, and an 'upset stomach' for a week. His SARS-CoV-2 RT-PCR nasal swab result was positive at an outside facility, and he recovered uneventfully. When seen a month later at his 18-month-old well-child check, his mother reported that since the illness, he had refused to eat. When fed, he would vomit within 5 minutes of eating at every meal. Subsequently, the patient's mother had been providing him with 200 mL of Pedialyte or Gatorade at each meal. He previously had tolerated all food since 5 months of age when solid food was introduced and had normal activity, adequate weight gain, and appropriate developmental milestone acquisition. Physical examination was unremarkable, with weight and height progressing at the 90th percentile curves and head circumference at the 70th percentile curve. It was noted that, around the same time as his COVID-19 diagnosis, his grandfather, with whom he was close, died of COVID-19. No additional diagnostic evaluation was performed, and mother was advised to continue offering solid food at each meal.

The pediatrician completed a follow-up phone call 2 months after his clinic visit and an in-person well-child check 4 months later. At the latter, the child was noted to alternate between eating "a lot" for 1 day and refusing to eat all food for 2 to 3 days, including the same food he tolerated on previous days. He had stopped vomiting and, overall, had normal activity and adequate weight gain. They adopted a pet dog to help the patient cope with the loss of his grandfather. Six months after diagnosis, another phone visit

documented his weight still at the 90th percentile. However, he continued to alternate between eating 3 meals a day, to going a week with eating once a day with 4 to 5 spoonful of soup and a few beans. He reportedly would chew meat, suck out the juice, and spit out the meat portion. He drinks water, juice and whole milk. On days in which he does not eat, mother would supplement Nido up to 500 mL a day. He was otherwise well and developing normally.

## LITERATURE REVIEW

Our review of the literature revealed limited published

reports that included a description of OGD in COVID-19 patients among children and adolescents. Among the total of 454 pediatric cases of COVID-19 included, 92 (20%) had OGD, none were <6 years of age (among reports with detailed age information), and no report clearly described food aversion as a finding in confirmed COVID-19 infection (Table 1). One study noted 16 children as presenting with “no feeding or feeding difficulty,” among whom age and OGD was not explicitly noted.<sup>2</sup> A separate group of 7 children was noted to have OGD in that cohort but not food aversion. Although there are some studies in

which researchers objectively measured OGD with COVID-19 disease and, in 1 study, researchers noted subclinical olfactory dysfunction in asymptomatic COVID-19 adolescents, the final diagnosis of OGD was typically made by patient self-report, which is difficult to impossible to obtain in preverbal children. The details of the basic demographics, timing, duration, and presence of OGD with other typical COVID-19 symptoms were often lacking in the reviewed literature. When reported, some children recovered quickly, and others persisted beyond at least 2 weeks from onset. In some children, OGD was the first and/or only manifestation of COVID-19.

**TABLE 1** Prevalence of OGD in Children with COVID-19

Country	All COVID-19 Cases, <i>n</i>	COVID-19 Cases With OGD, <i>n</i> (%) <sup>a</sup>	If OGD Present, Age Range	Other Information	Ascertainment Method
India <sup>3</sup>	141	40 (28) either olfactory or gustatory dysfunction; 28 of 40 (7) with both olfactory and gustatory changes <sup>b</sup>	10–19 y	OGD was first symptom in 14%; duration 2–15d	SR <sup>c</sup>
United States <sup>14</sup>	64	19 (30)	Not specified	OGD reported as combination of “nasal congestion/rhinorrhea/anosmia”	Not reported
France <sup>2</sup>	157	7 (5)	6–10 y	16 (10%) reported as “no feeding/feeding difficulty,” among whom age and OGD were not explicitly noted	SR
Israel <sup>15</sup>	31	8 (26)	11–17 y	Age-specific correlation of OGD score and nasal gene ACE expression	SR
China, France, and Germany <sup>16</sup>	27	10 (37); 7 of 10 (70) with both hyposmia and hypogeusia	15–17 y	OGD as only symptom in <25%	SR; olfactory testing in some Chinese children
Turkey <sup>17</sup>	3	3	13 y	No MRI changes in all patients; OGD resolved in 3–4 d in 2 patients	SR
Hong Kong <sup>18</sup>	3	3	14–17 y	Two with both anosmia and ageusia; duration 7 to >13 d	SR
Turkey <sup>19</sup>	27	1 (4)	11 y	Taste abnormality only; no other symptoms	SR
Indonesia <sup>20</sup>	1	1	17 y	Anosmia and ageusia	SR

SR, self report.

<sup>a</sup> Food aversion not reported explicitly in any previous report except perhaps Gaborieau et al<sup>2</sup> in children >6 y of age.

<sup>b</sup> No difference by age or sex.

## DISCUSSION

We describe, herein, 2 young children with acute onset of solid food aversion proximate to symptomatic COVID-19 disease, likely a result of altered olfactory and/or gustatory function. We believe that, for both cases, COVID-19 is the probable cause of OGD, given the clear temporal relationship of the OGD to infection, the lack of preexisting morbidity or concerns with feeding including normal growth and physical examination, the slow improvement over time consistent with adult data, and no credible alternative diagnosis identified. Interestingly, in addition to the change in eating habits, case 1 became acutely hypersensitive to the smell of any fragrant products at the same time as the food aversion, another sign of disruption in her olfaction. We believe food aversion, particularly in the context of a known contact or other directed information, should be a trigger to test for the presence of SARS-CoV-2 infection in preverbal children.

On follow-up encounters 6 to 8 months after diagnosis, both children were starting to tolerate some solid food, but neither had fully reached their baseline intake at the time of last assessment. This delayed and variable clinical course in our patients is consistent with recent studies in adults that have demonstrated that COVID-19–related OGD can wax and wane and one-third of patients may have persistent symptoms.<sup>3–5</sup> For children, however, our review did not identify clear patterns in this regard, most likely because of the small numbers of OGD cases and the lack of data in several of the reports. This may also be reflective of the reality that evaluation of OGD in children is not standardized and can be particularly difficult in young children.<sup>6</sup>

The olfactory and gustatory manifestations of COVID-19 may take many forms, including variations of overt anosmia (loss of smell), hyposmia (reduced smell), parosmia (distorted smell in the presence of a familiar odor source), and phantosmia (experience of smell in the absence of odor source). The gustatory findings include ageusia (loss of taste), amblygeusia and hypogeusia (reduced taste), and dysgeusia (distorted taste).<sup>4</sup> The pathophysiology of COVID-19–related OGD remains incompletely understood. Some hypotheses have been offered related to functional damage and/or inflammation of the olfactory and/or gustatory epithelium mediated via angiotensin-converting enzyme 2 and transmembrane protease, serine 2 proteins abundant in the oral and nasal cavity.<sup>7</sup>

To date, there is no standard or consensus management approach for patients with COVID-19–associated OGD in any age group. In this report, case 1 was admitted because of a choking episode and received subspecialty consultation while admitted, but follow-up was challenging and, ultimately, incomplete. Case 2 did not have an extensive evaluation given the lack of other clinical concerns and stable weight trajectory over time. It should be noted that only ~10% of young children with feeding difficulties require intensive intervention.<sup>8</sup> It remains to be determined if COVID-19–associated food aversion presents unique management issues from other feeding dysfunction; as evident in the review of current literature, more data are needed.

Although we believe our patients' OGD can be convincingly attributed to COVID-19 infection, we acknowledge here an extensive general differential diagnosis for OGD in this young age group (<2

years of age). Others have reviewed this topic (and the literature includes rare reports of other causal respiratory viruses<sup>9,10</sup>) for which our clinicians and the published reports (Table 1) did not routinely test. For our patients, other considerations are unlikely, such as food selectivity (usually transient and not affecting all foods, by definition) or more overt neurodevelopment syndromes. One might speculate that food aversion related to a fear of eating was operative after the choking episode (as in case 1) or an emotional event (case 2) or other parental pressure to eat after an initial period of decreased intake related to COVID-19 infection.<sup>8</sup> We do not believe these to be likely explanations, given that neither child had depressed mood or a change in any other social behaviors other than eating.

A variety of behavioral, developmental, and emotional concerns potentially related to COVID-19 have been reported in children as young as 3 years of age.<sup>11</sup> One of our cases had speech regression that we recognize may or may not be associated with this child's COVID-19 infection, although COVID-19–related regression in the speech domain has not been previously linked with this infection. A variety of other neurologic and mental health complications of COVID-19 have been reported in both pediatric and adult populations.<sup>12,13</sup> We cannot, at this time, determine if this finding is or is not independent of the COVID-19 infection, and more pediatric data are needed.

We believe that pediatric providers should be aware that OGD may be the first or only clue to the diagnosis of this infection among preverbal children and may need to be part of anticipatory guidance after COVID-19 infection in young children. We encourage others to consider this diagnosis and publish their

experience, such that a fuller picture of the appropriate management and prognosis can be defined.

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## ABBREVIATIONS

COVID-19: coronavirus disease 2019

OGD: olfactory and gustatory dysfunction

RT-PCR: reverse transcription-polymerase chain reaction

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

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