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## Does COVID-19 cause permanent damage to olfactory and gustatory function?

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### ABSTRACT

The objective of this study was to investigate the status of COVID-19 patients with sudden anosmia and dysgeusia using an olfactory dysfunction questionnaire highlighting recovery times. This prospective study included 75 patients who completed a patient-reported outcome questionnaire. Among these, 46 patients completed an olfactory evaluation based on the duration of anosmia and dysgeusia. The olfactory evaluation revealed that 24% (N = 18) of patients had mild hyposmia, 13% (N = 10) had moderate hyposmia, 30% (N = 23) had severe hyposmia, 32% (N = 24) had anosmia, and 100% had dysgeusia (N = 75). The viral load significantly decreased throughout the 17 days following the onset of the olfactory disorder. The purpose of this study was to understand whether patients with COVID-19 can recover olfactory and gustatory function, in contrast to patients with other rhinoviruses and inflammatory diseases such as rhinosinusitis chronic and rhinosinusitis with polyps. These preliminary clinical findings indicate that the relatively rapid recovery of olfactory and gustative function can mean a resolution of viral infection in most patients. The present study suggests that coronavirus can induce olfactory dysfunction but not permanent damage. Olfactory and gustatory functional impairment has been recognized as a hallmark of COVID-19 and may be an important predictor of clinical outcome. Our study supports the need to add anosmia and dysgeusia to the list of symptoms used in screening tools for possible COVID-19 infection.

### Hypotheses

Does COVID-19 cause permanent damage to olfactory and gustatory function? Viral upper respiratory tract infection is a common cause of olfactory dysfunction, in part because the olfactory epithelium is located adjacent to the respiratory epithelium, the site of replication of multiple viruses that cause upper respiratory tract infection, and because olfactory neurons directly access the environment. Olfactory and gustatory dysfunction have recently been found to be associated with COVID-19 infection. The growing number of internet searches inquiring about loss of smell strongly correlates with the increased prevalence of COVID-19. In addition, there have been a rapidly growing number of reports of a significant increase in the number of patients presenting with anosmia in the absence of other symptoms, which has been widely shared on medical discussion boards by surgeons from all regions managing a high incidence of cases. The peripheral involvement hypothesis is supported by consolidated evidence that upper airway viral infections can cause sensorineural olfactory alterations following selective damage to the sensory olfactory epithelium. The presence of rhinovirus, coronavirus, parainfluenza virus, and Epstein-Barr virus in patients with postviral olfactory dysfunction has been demonstrated,

suggesting that these viruses could cause olfactory dysfunction not only through nasal obstruction but also through direct damage to the sensory epithelium, leading to transient or persistent olfactory dysfunction. The purpose of the study was to monitor COVID-19-positive patients and determine whether they have a possibility of functional olfactory and gustatory recovery, in contrast to patients with other rhinoviruses and inflammatory diseases such as rhinosinusitis chronic and rhinosinusitis with polyps. [1] Few data are available in the literature on the outcome of recovery time for olfactory and gustatory dysfunction during COVID-19 infection. The Klopfenstein [2] and Hopkins [3] studies have shown that the mean duration of anosmia was 1–21 days, and 98% of patients recovered after 28 days. [4]

### Evaluation of the hypotheses

Outcomes were examined in 75 patients. Olfactory-specific quality of life can be measured using the Questionnaire of Olfactory Dysfunction, which examines various aspects of olfactory dysfunction.

Patients were invited to participate, and informed consent was obtained. The following exclusion criteria were considered: patients with olfactory or gustatory dysfunction before the COVID-19 epidemic,

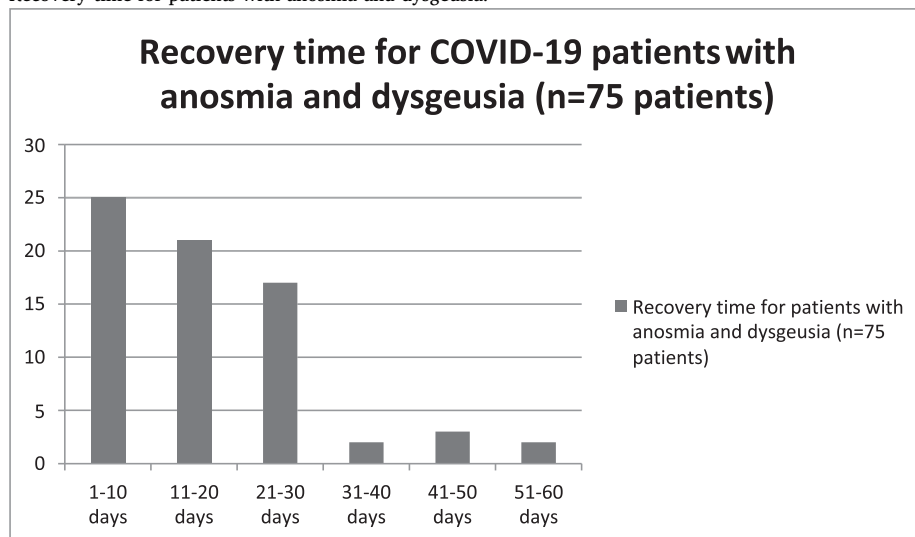
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**Table 1**

Recovery time for patients with anosmia and dysgeusia.

**Table 2**

Questionnaire on Olfactory Dysfunction post-COVID-19.

Questionnaire on Olfactory Dysfunction Post-COVID-19 (75 pts)		
Self-reported olfactory and gustatory dysfunction		
Item 1	Mild hyposmia	18/75(24%)
Item 2	Moderate hyposmia	10/75(13%)
Item 3	Severe hyposmia	23/75(30,6%)
Item 4	Anosmia	24/75(32%)
Item 5	Dysgeusia	75/75(100%)
Olfactory and Dysgeusia Recovery		
Item 6	Average recovery time for mild, moderate, and severe hyposmia	17 days
Item 7	Average recovery time for anosmia and dysgeusia.	17 days

patients with a history of rhinosinusitis or nasal polyposis, and patients with a history of nasal surgery including those with or without functional endoscopic sinus surgery. Self-reported anosmia and dysgeusia in COVID-19-positive patients were identified as common symptoms: mild hyposmia (24%), moderate hyposmia (13%), severe hyposmia (30%), anosmia (32%) and dysgeusia (100%). The most significant finding was olfactory and dysgeusia recovery within an average of 17 days. All patients reported the onset of hyposmia, anosmia and dysgeusia prior to admission (Table 1 and Table 2).

## Conclusions

Although the mechanism of olfactory and gustatory function loss remains unclear [5], these preliminary clinical findings may indicate that relatively rapid recovery of olfactory and gustative function can mean a resolution of viral infection in most patients, and there was no distinction between hyposmia, anosmia and dysgeusia, contrary to what was found in other studies. [6] The analysis of our sample revealed that COVID-19 does not seem to cause permanent injury to olfactory and gustatory function because complete recovery occurs after two weeks. Self-reported olfactory and dysgeusia impairment has been recognized as a hallmark of COVID-19 and may be an important predictor of clinical outcome. Such alterations are mainly transient, with a complete/partial recovery within a few weeks, although no clear evidence is available yet. The present study suggests that coronavirus can induce a period of olfactory and gustatory dysfunction, but in the

studied population, it does not cause permanent damage.

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None.

## Compliance with Ethical Standards

The Ethics Committee of Brescia (ASST Spedali Civili di Brescia) approved the study protocol (NP 4138-12.05.2020).

## Informed consent

Patients were invited to participate, and informed consent was obtained.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.mehy.2020.110086>.

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