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## Letter to the Editor

### Persisting olfactory dysfunction in patients after recovering from COVID-19



Dear Editor,

As reported in this Journal by Noh et al., some series of COVID-19 include at least 25% of patients with anosmia<sup>1</sup>. Olfactory dysfunction is one of the key symptoms for the virus' neurotropism, with the olfactory cleft as a possible entry for the virus into the CNS<sup>2,3</sup>.

The above-mentioned study, like other studies, reported a rapid recovery of olfactory symptoms in affected patients within a few weeks after initial onset, but these results were only based on self-reports<sup>1,4</sup>. Of note, it is difficult to self-assess olfactory function and thus, anamnestic surveys of the olfactory are of limited value<sup>5</sup>. However, the duration of the olfactory dysfunction in COVID-19 disease might be of major importance to signal persistence of the virus close to the CNS and possible long-term neurological affection.

In otorhinolaryngology, fine-grained smelling tests are well-established to quantify olfactory dysfunctions in people. We here applied the Sniffin' Sticks battery<sup>6</sup>, a comprehensive standardized and validated smelling test battery in 50 patients after recovering from COVID-19. We found that 7 weeks after the start of COVID-19 50% of patients still suffered from an olfactory dysfunction despite reporting full recovery. Subtests analysis showed that not only indicators of peripheral, but also indicators of central olfactory function remained impaired.

The Sniffin' Sticks battery is a comprehensive psychophysiological smelling test, used clinically for therapeutic decisions based on not only olfactory identification (I), but also olfactory threshold (T) and discrimination (D). While the olfactory threshold corresponds to the peripheral olfactory system, identification and discrimination are thought to at least partially represent central olfactory performances. The 3 subtests form the TDI score, representing the overall olfactory function.

Our sample consisted of 50 consecutive patients (mean age 43.2 years (range 23–69) who presented in the outpatient clinic for recovered COVID-19 patients at the University of Cologne, Germany. All of them were PCR-confirmed COVID-19 cases, having recovered at least three weeks previously. 94% of patients reported a sudden loss of smell during the course of the disease. At the time of olfactory testing, 38% of the patients stated to still suffer from olfactory impairment, while 61.7% of the patients reported that smelling recovered completely.

Sniffing test results indicated that 26 patients (52%) were hyposmic (mean TDI: 26.86), whereas only 23 patients (46%) were normosmic (mean TDI: 34.23). One subject (1.9%) had a TDI score of 11 and was therefore considered anosmic. The results of the olfactory TDI subtests significantly differed between normosmic and

hyposmic patients, i.e. hyposmic patients suffered from olfactory identification, discrimination and showed a lower threshold (all  $p < 0.003$ ). Both groups were homogenous ( $p > 0.05$  each) in terms of patients' age, sex, smoking history and the number of days passed since PCR virus detection or onset of symptoms. Interestingly, subjective estimation of the olfactory function by the patients correlated weakly with the determined TDI values. In the group of normosmics ( $n=23$ ), 7 participants (30.43%) complained of subjectively persistent olfactory problems, 16 (69.57%) did not. In the hyposmic group ( $n=26$ ), only half of the patients ( $n=13$  (50%)) continued to complain, while the rest felt recovered.

We feel that clinicians should be aware that olfactory dysfunction may persist in patients after recovering from COVID-19, even if the patients themselves state otherwise. Likewise, reported prevalences of olfactory impairment in COVID-19 patients may well be underestimated as patients' self-assessment. Using established smelling tests is an appropriate tool to characterize olfactory dysfunction in more detail.

#### Declaration of interests

All authors declare no competing interests.

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