

Behind the Mask: Recognizing Facial Features of Parkinson's Disease During the COVID-19 Pandemic

Parkinson's disease (PD) remains a clinical diagnosis.¹ Charcot stated that these patients could be “diagnosed from afar” and described the “masked facies,” namely, “the immobility of [...] facial features.”^{2,3} The MDS-UPDRS part III scores facial expression from 0 to 4, according to several features in silence and while talking.⁴

Face masks became ubiquitous because of the COVID-19 outbreak, covering the nose and the mouth and thus concealing the lower half of the face. We investigated the influence of surgical masks on the recognition of facial features suggestive of PD (FFPD).

The faces of PD patients and healthy controls were video-recorded in 4 scenarios for a period of 20 seconds each: (1) silent with mask, (2) talking with mask, (3) silent without mask, and (4) talking without mask (details in supplementary file 1). Only PD patients with the “facial expression” UPDRS item ≥ 1 were included. Exclusion criteria were facial palsy, facial dyskinesia/dystonia, visible tremor, and atypical parkinsonism. Controls were assessed to exclude parkinsonian features; those with history of depression or antipsychotic therapy were excluded. The videos were randomly assigned to 6 blinded expert movement disorder neurologists from 3 centers, who classified FFPD for each subject with and without mask and also their level of assessment confidence (from 1 to 10).

We consecutively included 45 PD patients and 32 controls. A total of 450 assessments were performed: 2 evaluations per subject (with/without mask) times the number of raters (Table 1). The assessment confidence level increased significantly both in PD and controls after subjects took the masks off ($P < 0.001$). The eyeblinking rate was lower in PD patients compared with controls (with mask: 0.62 vs 1.09, $P = 0.01$; without mask: 0.79 vs 1.18, $P = 0.029$). PD patients had a significantly lower eyeblinking frequency with masks (0.62 vs 0.79, $P = 0.03$). Neurologists changed their impression 28.1% of the time after masks were removed, more frequently

of controls than of PD patients (18.9% vs 9.2%, $P < 0.03$). A significant number of masked controls correctly identified as not having FFPD were reclassified after face masks was removed (4.6% vs 15.8%, $P < 0.01$).

Our study provides insights into the effects of face masks on the recognition of FFPD. First, the ability of neurologists to identify or exclude FFPD is largely unaffected by masks, but their use decreases diagnostic confidence (supplementary video, segment 1). Second, we found that PD patients showed reduced eyeblinking frequency with masks on (segment 2). The reason for this is unclear but may have implications in clinical practice because patients may appear more bradykinetic. Third, neurologists overidentified features of PD in controls, particularly after removing the mask (segment 3). The reason for this is also unclear but may refer to the effects of priming and cognitive biases when assessing visual clues.^{5,6} Limitations of our study include low to moderate interrater agreement (supplementary file 2), in line with previous studies.⁷ Face masks are likely to remain an integral part of daily life for a long time. This study suggests that the influence of masks in clinical practice, especially regarding the recognition of FFPD, should be taken into account and deserves further research.

Ethical Approval

This study was carried out with the approval of the ethics committee and in accordance with the Declaration of Helsinki. ■

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References

1. Postuma RB, Berg D, Stern M, et al. MDS clinical diagnostic criteria for Parkinson's disease. *Mov Disord* 2015;30(12):1591–1601.
2. Salomone G, Arnone R. Charcot and his drawings: images from “les leçons du mardi a la Salpêtrière 1887-1888.” *Ital J Neurol Sci* 1994;15(4):203–211.
3. Hall AJ. A note on the “so-called Parkinson's mask.” *Br Med J* 1923; 2(3262):25–26.
4. Goetz CG, Tilley BC, Shaftman SR, et al. Movement Disorder Society-sponsored revision of the unified Parkinson's disease rating

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TABLE 1 Analysis of Parkinson's disease patients and healthy controls

	Parkinson's disease patients (n = 45)	Healthy controls (n = 32)	P
Demographics and clinical characteristics			
Age (y), mean ± SD	69.2 ± 10.3	69.3 ± 8.8	0.96
Sex, male, %	55.6%	37.5%	0.12
Duration of disease (y), mean ± SD	8.47 ± 5.82	—	—
Hoehn & Yahr stage of disease, mean ± SD	2.13 ± 0.55	—	—
LED (mg), mean ± SD	565.98 ± 385.79	—	—
Neurologists' evaluations of recordings			
Diagnostic accuracy without mask (%)	82.3%	55.8%	< 0.001 ^e
Diagnostic accuracy consistent w/wo mask, %	77.7%	52.6%	< 0.001 ^e
Diagnostic accuracy with mask, %	82.3%	68.4%	< 0.001 ^e
Confidence level with mask (from 0 to 10), mean ± SD ^a	6.62 ± 1.10	6.57 ± 0.93	0.85
Confidence level without mask (from 0 to 10), mean ± SD ^a	7.85 ± 1.38	7.44 ± 1.02	0.17
Confidence with vs without mask, P	< 0.001 ^e	< 0.001 ^e	—
Eyeblink rate with mask (blinks/s), mean ± SD ^b	0.62 ± 0.59	1.09 ± 0.61	0.01 ^e
Eyeblink rate without mask (blinks/s), mean ± SD ^b	0.79 ± 0.82	1.18 ± 0.66	0.029 ^e
Eyeblink rate w/wo mask, P	0.03 ^e	0.22	—
Total changes (n = 225 evaluations), ^c %	9.2%	18.9%	0.03 ^e
Type of change: presence of facial features of PD → no facial features of PD, ^d %	4.6%	3.1%	0.582
Type of change: no facial features of PD → presence of facial features of PD, ^d %	4.6%	15.8%	< 0.01 ^e
P (changes in evaluations) ^e	1	< 0.01 ^e	—

^aHigher score denotes higher degree of confidence.

^bThe eyeblinking rate was calculated by dividing the number of blinks over the time of recording.

^cWhen neurologists shifted their evaluation after mask was removed.

^dBefore and after removing the mask.

^eStatistically significant.

LEDD, levodopa-equivalent dose; SD, standard deviation; w/wo, with and without; vs, versus.

scale (MDS-UPDRS): scale presentation and clinimetric testing results. *Mov Disord* 2008;23(15):2129–2170.

- James TW, Humphrey GK, Gati JS, Menon RS, Goodale MA. The effects of visual object priming on brain activation before and after recognition. *Curr Biol* 2000;10(17):1017–1024.
- Mueller R, Utz S, Carbon CC, Strobach T. Face adaptation and face priming as tools for getting insights into the quality of face space. *Front Psychol* 2020;11:166.

- Richards M, Marder K, Cote L, Mayeux R. Interrater reliability of the unified Parkinson's disease rating scale motor examination. *Mov Disord* 1994;9(1):89–91.

Supporting Data

Additional Supporting Information may be found in the online version of this article at the publisher's web-site.