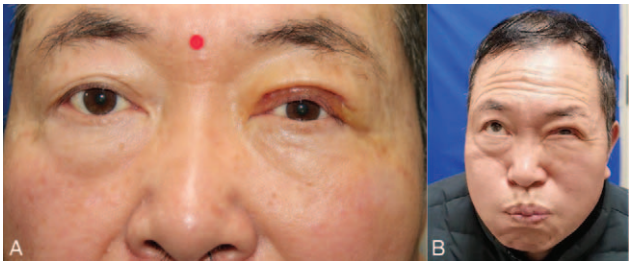

FIGURE 4. A, At 1 week postoperative, margin reflex distance 1 in the left eye was 2 mm, cosmesis and the contour of this upper eyelid were improved. B, The involuntary synkinetic eyelid movement did not cease completely but improved after surgery.

during oral movements.[2] The buccinator muscle and the orbicularis oris, which are innervated by other branches of the facial nerve, function in cheek-puffing movements. Aberrant facial nerve regeneration associated with cheek puffing after Bell palsy is usually thought to result from 3 possible pathogenetic mechanisms: aberrant axonal regeneration, aberrant nerve impulse transmission, and hyperexcitability of the nucleus of the facial nerve.[3] The buccinator muscle is located deep to the skin and is mostly covered by the masseter and more superficial facial muscles. Early EMG evaluation of the buccinator in humans indicated that it is strong and active during most oral functions, including sucking, blowing, swallowing, smiling, and speech, and the buccinator was generally associated with the orbicularis oris muscle. Because of this close relationship between the buccinator with orbicularis oris muscle, EMG of this muscle was examined as well.[4–6] Similarly, the patient in the present case underwent EMG to confirm the diagnosis, and the test demonstrated synkinesis of the orbicularis oculi and oris because twitching of the orbicularis oris is caused by attempting eyelid closure. However, it was technically difficult to exactly locate the aberrant nerve fiber.

Aberrant facial nerve regeneration is a long-term complication after facial nerve palsy and may cause ptosis. The variable ptosis is due to increased muscle tone in the orbicularis oculi on the affected side and is exacerbated by synkinesis.[1,7] In AFR, both the upper and lower MRD are usually significantly reduced on the affected side. Both of these indices decreased in the patient in the present case demonstrating that signs of AFR include a reduced a palpebral aperture secondary to increased OOM tone.

Facial synkinesis is defined as any involuntary movement observed in a facial region other than that which is voluntarily moved.[8] Marin-Amat syndrome is a type of AFR, but this syndrome involves synkinesis of the orbicularis oculi and jaw movements. It is caused by acquired aberrant anastomosis of the trigeminal (CN V) and facial (CN VII) nerves.[9,10] Inverse Marcus-Gunn syndrome is characterized as a congenital involuntary closure of the eyelid on jaw opening.[11] Oh et al demonstrated an EMG that showed the cocontraction of the ipsilateral pterygoid muscle (innervated by CN V) and OOM (CN VII) in a patient with inverse Marcus-Gunn syndrome.[12] Many authors supported this hypothesis. However, the precise mechanism remains uncertain.

Low-dose Botulinum toxin A (BTXA) has been used to treat synkinetic eyelids.[13,14] It is a useful treatment option for patients who suffer the motor and autonomic effects of AFR. Unfortunately, one study showed that the facial synkinesis usually recurred 2 to 3 months after treatment, and patients will need repeat injections.[14]

In conclusion, it is very important to recognize AFR and to identify the causes of ptosis. The diagnosis can be made by the presence of an increase in ptosis with cheek puffing and a decrease in the palpebral aperture with upper and lower MRD reduction. Levator advancement combined with OOM resection of the involved eyelid is affective technique to treat synkinetic eyelid closure in patients with AFR.

REFERENCES

1. Monteserra L, Benito M. Facial synkinesis and aberrant regeneration of facial nerve. *Adv Neurol* 1998;49:211–224
2. Tyers AG, Collin JR. Colour Atlas of Ophthalmic Plastic Surgery. 2nd ed. Oxford, United Kingdom: Butterworth-Heinemann; 2001:1–18
3. Terzis JK, Karypidis D. Therapeutic strategies in post-facial paralysis synkinesis in pediatric patients. *J Plast Reconstr Aesthet Surg* 2012;65:1009–1018
4. Perkins RE, Blanton PL, Biggs NL. Electromyographic analysis of the "buccinator mechanism" in human beings. *J Dent Res* 1977;56:783–794
5. Blanton PL, Biggs NL, Perkins RC. Electromyographic analysis of the buccinator muscle. *J Dent Res* 1970;49:389–394
6. Vitti M, Basmajian JV, Ouellette PL, et al. Electromyographic investigations of the tongue and circumoral muscular sling with fine-wire electrodes. *J Dent Res* 1975;54:844–849
7. Celik M, Forta H, Vural C. The development of synkinesis after facial nerve paralysis. *Eur Neurol* 2000;43:147–151
8. Moran CJ, Neely JG. Patterns of facial nerve synkinesis. *Laryngoscope* 1996;106:1491–1496
9. Rana PV, Wadia RS. The Marin-Amat syndrome: an unusual facial synkinesis. *J Neurol Neurosurg Psychiatry* 1985;48:939–941
10. Pavone P, Garozzo R, Trifiletti RR, et al. Marin-Amat syndrome: case report and review of the literature. *J Child Neurol* 1999;14:266–268
11. Prakash MV, Radhakrishnan M, Yogeshwari A, et al. Inverse Marcus Gunn phenomenon. *Indian J Ophthalmol* 2002;50:142–144
12. Oh JY, Kim JE, Kim YJ, et al. A case of familial inverse Marcus Gunn phenomenon. *J Neurol Neurosurg Psychiatry* 2003;74:277–278
13. Desai S, Upadhyay M, Nanda R. Dynamic smile analysis: change with age. *Am J Orthod Dentofacial Orthop* 2009;136:310–311
14. Kotsia I, Pitas I. Facial expression recognition in image sequences using geometric deformation features and support vector machines. *IEEE Trans Image Process* 2007;16:172–187

Subjective Smell Assessment as An Office-based Rapid Procedure In COVID-19 Era

Mosaad Abdel-Aziz, MD, Nada M. Abdel-Aziz, BDS,† Dina M. Abdel-Aziz, MBBCh,‡ and Noha Azab, MD§*

Abstract: A recent history of smell disorder may be a potential predictor for COVID-19. The authors used a subjective olfaction score that was demonstrated on a hard paper-bar. The authors examined 480 patients who were attending the outpatient clinic. Ninety-seven patients (20.2%) demonstrated variable degrees of recent smell disorder. For those patients, lab testing including nasopharyngeal swab for real-time polymerase chain reaction (RT-PCR) was performed. Eighty-eight of them (90.7%) have been confirmed to be COVID-19 positive. Although psychophysical testing is more reliable, subjective assessment of smell is a rapid procedure and can be used as an office-based method for patients' screening in COVID-19 era. Smell disorder could be

© 2020 Mutaz B. Habal, MD

Copyright © 2021 Mutaz B. Habal, MD. Unauthorized reproduction of this article is prohibited.

an alarming sign for COVID-19 even with absent characteristic symptoms.

Key Words: Anosmia, COVID-19, olfaction, smell assessment, smell disorder

Coronavirus disease 2019 (COVID-19) is a highly infectious illness of the respiratory tract caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease caused a major health impact all over the world as large number of patients needed hospitalization and mechanical ventilation.[1] The spread of infection occurs through respiratory droplets inhaled by a healthy individual from an infected patient. However, infection may result from touching surfaces or objects where the virus is present, which can be transmitted by the hands to the nose, mouth or eyes. SARS-CoV-2 can persist in an infectious state on surfaces for several days, so, surface disinfectant such as 0.1% sodium hypochlorite or 62% to 71% ethanol for 1 minute could be used to prevent dissemination of the disease.[2]

The commonest clinical manifestations of COVID-19 are fever, fatigue, cough, and expectoration, other symptoms including myalgia, anorexia, chest tightness, shortness of breath, and dyspnea.[3] However, smell disorder with or without taste impairment is a well-known feature of the disease. In a USA study carried out on patients with influenza-like symptoms, loss of smell was found in 68% of COVID-19-positive patients compared to 16% of COVID-19 negative subjects.[4] A multicenter study carried out in 4 European countries showed smell disorder in 85.6% of COVID-19 patients.[5] Furthermore, a case control study that was conducted on 60 COVID-19 Iranian patients showed the disorder with variable degrees in 98% of patients.[6] However, those patients might be unaware of their smell problem.[7] Some authors reported that most of the persons who contacted COVID-19 patients may develop some degree of smell disorder without nasal congestion or inflammation, they also found that only 35% of positive patients who had olfactory dysfunction were aware of their smell problem before objective testing.[6] Psychophysical testing of smell such as the Sniffin Sticks test (Burghart; Wedel, Germany) and the University of Pennsylvania Smell Identification test (Sensonics Inc., Haddon Heights, NJ) are valuable methods for evaluation of smell disorder, however, they are not usually available during the general medical examination, as well as being time consuming and costly.[8] So, we used a rapid office-based subjective smell assessment method in an attempt to screen patients who may have COVID-19 without typical symptoms.

From the *Department of Otolaryngology, Cairo University; †October University of Modern Science and Arts (MSA); ‡Misr University for Science and Technology (MUST); and §Department of Rheumatology and Rehabilitation, Cairo University, Egypt.

Received August 30, 2020.
Accepted for publication September 28, 2020.

Address correspondence and reprint requests to Mosaad Abdel-Aziz, MD, Address: 2 el-salam st., King Faisal, above el-baraka bank, Giza, Cairo, Egypt, ORCID: 0000-0002-7250-5388;
E-mail: mosabeez@hotmail.com, mosaadabdel-aziz@staff.cu.edu.eg

The research protocol of this study was approved by the Ethics Committee of Faculty of Medicine of Cairo University.
The authors report no conflicts of interest.
Supplemental digital contents are available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jcraniofacialsurgery.com).

Copyright © 2020 by Mutaz B. Habal, MD

ISSN: 1049-2275
DOI: 10.1097/SCS.0000000000007245

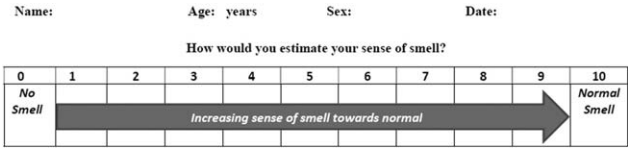

FIGURE 1. A hard paper-bar demonstrating the subjective olfaction score.

MATERIALS AND METHODS

Subjective smell assessment was done for 480 patients who attended our outpatient clinic for medical service, in the period from 1st of April to the end of July 2020. They were 266 males and 214 females; their ages ranged between 18 and 60 years with a mean age of 36 years. Pediatric patients and those who had past history of smell disorder were excluded. Also, patients with symptoms suggestive of COVID-19 such as fever, cough and/or dyspnea were excluded. We obtained a written informed consent from all patients, and we followed the items outlined in the Declaration of Helsinki. Also, we obtained approval for the study protocol from the Research Ethics Committee of our institute.

We demonstrated the subjective olfaction score that was used by Yan et al[4] on a hard paper-bar. The score was graded from 0 to 10 (Fig. 1), where the patient was asked to answer a question "How would you estimate your sense of smell." In the waiting room, the assistant staff gave patients the hard paper-bar, and the patients were requested to rate his smell score exactly by checking opposite the appropriate grade, where 0: complete loss of smell, 10: normal smell, and scores from 1 to 9 mean progressive increase of smell towards normal. Nasopharyngeal swab was performed for patients with smell dysfunction, using real-time polymerase chain reaction (RT-PCR) as a diagnostic criterion for COVID-19. Also, fifty of our patients who had normal smell, and they were age and sex matched to the affected patients (28 males and 22 females, with a mean age 39 years) were taken as a control group, and they were tested for COVID-19 by nasopharyngeal swab.

Statistical Method

We compared the results of COVID-19 testing in patients with smell disorder and in normal control subjects using Chi square test. Also, by using Mann-Whitney *U* test, the association of COVID-19 positive results and the grade of smell affection reported by the patients was investigated. A P value of ≤ 0.05 was considered significant.

RESULTS

Along a period of four months, we evaluated 480 patients for smell disorder using the subjective olfaction score. Ninety-seven patients (20.2%) demonstrated variable degrees of recent smell disorder, with more than two-thirds of them showed smell scores 0 to 5 (Supplementary Digital Content, Table 1, http://links.lww.com/SCS/C73). Eighty-eight (90.7%) of those patients who demonstrated smell disorder have been confirmed to be COVID-19 positive on lab testing. Whereas, only 3 (6%) of the control subjects were COVID-19 positive. The comparison between both groups was statistically significant.

The association of COVID-19 positive results and the grade of smell affection reported by the patients was statistically insignificant. Therapeutic measures were supplied for the patients, in parallel with olfactory training procedures.

DISCUSSION

Head and neck surgeons, oral and maxillofacial surgeons, and Dentists are at a high risk of infection with SARS-CoV2 as they are usually in a close contact with their patients during examination

Copyright © 2021 Mutaz B. Habal, MD. Unauthorized reproduction of this article is prohibited.

and therapeutic interventions.[9] So, during the current pandemic, most routine procedures have been suspended, and only emergency procedures and surgeries are being performed.[10] Chigurupati et al[11] reported that oral and maxillofacial surgeons in different medical centers have made schedule changes to manage medical emergencies with taking special precautions such as using airborne infection isolation rooms / negative pressure rooms, telemedicine triage, and appropriate personal protective equipment (PPE) for aerosol generating procedures (including eye protection and filtered face respirators (N-95), face shields, powered air-purifying respirators).

The screening of COVID-19 patients and the detection of asymptomatic patients still represent a challenge for health care providers. Medical triage method may give clinicians the possibility for detecting infected patients before attending medical examination. Cervino and Oteri[12] described 2 phases for triage, initially by telephone then in-office. Triage by telephone includes a questionnaire about the patient's general health, common symptoms of COVID-19, as well as patient's contact with infected subjects. As the telephone triage may be carried out during the asymptomatic incubation period of the disease, a second in-office triage should be performed and signed. Also, Barca et al[13] recommended the same method of triage before surgical intervention. Triage could decrease the transmission of infection to health care providers. Since olfactory affection may occur at the initial stage of COVID-19 usually with mild clinical symptoms and even in asymptomatic patients,[7,14] a recent history of smell disorder may be a potential predictor for the disease and can be used as screening method.

In this study, we evaluated smell affection among 480 patients who attended the outpatient clinic without the typical known symptoms of COVID-19. Subjective smell assessment was used as psychophysical assessments were not available in our center. Ninety-seven patients (20.2%) demonstrated variable degrees of recent smell disorder, 88 of them (90.7%) have been confirmed COVID-19 positive on lab testing. However, 3 out of 50 (6%) control subjects have been confirmed COVID-19 positive. The comparison between smell disordered cases and normal subjects was statistically significant. Yan et al[4] detected smell affection in 68% of COVID-19 positive patients with influenza like symptoms, the study was carried out through an email questionnaire. Whereas, Moein et al[6] reported smell disorder in 98% of COVID-19 patients using quantitative psychophysical method. However, the wide variability of incidence among COVID-19 patients may be attributed to the difference between quantitative and self-reported olfactory assessment, and also the presence of other more severe symptoms may attract the attention of patients who could underestimate hyposmia.[15]

Smell disorder could be an early alarming sign for COVID-19. It can occur in asymptomatic and/or paucisymptomatic patients.[14] Unfortunately, some patients may be unaware of their smell problem especially if it is mild.[7] So, smell assessment may be mandatory especially for contacts of COVID-19 patients, and for people in areas with high infection rate. In our study, we found insignificant association between smell disorder score and the results for COVID-19 nasal swab that may indicate that COVID-19 disease is associated with smell affection irrespective to its degree. Indeed, subjective assessment of smell is a crude procedure, yet it is a simple rapid method that can detect smell affection in COVID-19 era especially in centers providing medical health services.[16] Yan et al[15] stated that self-reported olfactory dysfunction has recently been detected as a hallmark of COVID-19 and could be a diagnostic predictor of the disease. It can be used by the assistant staff as an office-based screening procedure in the waiting area of the patients before medical examination.

It is worth mentioning that quantitative psychophysical tests such as the Sniffin Sticks test (Burghart; Wedel, Germany) and the University of Pennsylvania Smell Identification test (Sensonics Inc, Haddon Heights, NJ) are more reliable methods for smell assessment, however, they are not available in our center. Also, it is costly and time consuming, hence we used the subjective assessment of smell that may have debatable accuracy.

CONCLUSION

Subjective assessment of smell is a rapid procedure and can be used as an office-based method for patients' screening in COVID-19 era. Smell disorder could be an alarming sign for COVID-19 even with absent characteristic symptoms and irrespective to its degree. Early diagnosis of COVID-19 patients who may not have the typical symptoms could decrease disease spread.

REFERENCES

1. Cavallo L, Marcianò A, Cicciù M, et al. 3D Printing beyond dentistry during COVID 19 epidemic: a technical note for producing connectors to breathing devices. *Prosthesis* 2020;2:46–52
2. Fiorillo L, Cervino G, Matarese M, et al. COVID-19 surface persistence: a recent data summary and its importance for medical and dental settings. *Int J Environ Res Public Health* 2020;17:3132
3. Fallahi HR, Keyhan SO, Zandian D, et al. Being a front-line dentist during the Covid-19 pandemic: a literature review. *Maxillofac Plast Reconstr Surg* 2020;42:12
4. Yan CH, Faraji F, Prajapati DP, et al. Association of chemosensory dysfunction and COVID-19 in patients presenting with influenza-like symptoms. *Int Forum Allergy Rhinol* 2020;10:806–813
5. Lechien JR, Chiesa-Estomba CM, De Siati DR, et al. Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): a multicenter European study. *Eur Arch Otorhinolaryngol* 2020;277:2251–2261
6. Moein ST, Hashemian SM, Mansourafshar B, et al. Smell dysfunction: a biomarker for COVID-19. *Int Forum Allergy Rhinol* 2020;10:944–950
7. Abdel-Aziz M. Smell disorder could warn head and neck surgeons for diagnosis of covid-19. *J Craniofac Surg* 2020;31:e635–e636
8. Zou L, Linden L, Cuevas M, et al. Self-reported mini olfactory questionnaire (self-MOQ): A simple and useful measurement for the screening of olfactory dysfunction. *Laryngoscope* 2019. doi: 10.1002/lary.28419. [published ahead of print]
9. Huntley RE, Ludwig DC, Dillon JK. Early effects of covid-19 on oral and maxillofacial surgery residency training—results from a national survey. *J Oral Maxillofac Surg* 2020;78:1257–1267
10. Zhiguo Z, Dan G. Precaution of 2019 novel coronavirus infection in department of oral and maxillofacial surgery. *Br J Oral Maxillofac Surg* 2020;58:250–253
11. Chigurupati R, Panchal N, Henry AM, et al. Considerations for oral and maxillofacial surgeons in covid-19 era: can we sustain the solutions to keep our patients and healthcare personnel safe? *J Oral Maxillofac Surg* 2020;78:1241–1256
12. Cervino G, Oteri G. COVID-19 pandemic and telephone triage before attending medical office: problem or opportunity? *Medicina* 2020;56:250
13. Barca I, Cordaro R, Kallaverja E, et al. Management in oral and maxillofacial surgery during the COVID-19 pandemic: our experience. *Br J Oral Maxillofac Surg* 2020;58:687–691
14. Vaira LA, Salzano G, Deiana G, et al. Anosmia and ageusia: common findings in COVID-19 patients. *Laryngoscope* 2020;130:1787–11787
15. Yan CH, Faraji F, Prajapati DP, et al. Self-reported olfactory loss associates with outpatient clinical course in Covid-19. *Int Forum Allergy Rhinol* 2020;10:821–831
16. Mullol J, Alobid I, Mariño-Sánchez F, et al. The loss of smell and taste in the COVID-19 outbreak: a tale of many countries. *Curr Allergy Asthma Rep* 2020;20:61

© 2020 Mutaz B. Habal, MD

Copyright © 2021 Mutaz B. Habal, MD. Unauthorized reproduction of this article is prohibited.