The Impact of COVID-19 on the Personal Protective Equipment Practices and Preferences of Craniofacial Surgeons

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Background: The COVID-19 pandemic has raised concern about healthcare worker exposure risk. Surgeons operating near the aerodigestive tract are at particularly high risk, given the respiratory spread of SARS-CoV-2. This study examines the practices and opinions of craniofacial surgeons as they adapt to a worldwide epidemic.

Methods: An electronic survey study was conducted on practicing craniofacial surgeons regarding their preference of personal protective equipment use before, during, and after the pandemic in patients with or without COVID-19 infection, as well as demographic data. Statistical analysis was performed to compare changes in behaviors and preferences and differences across demographic groups.

Results: Craniofacial surgeons changed their behaviors significantly during the pandemic, with 91.5% of respondents wearing N95 masks or powered air purifying respirators for operations involving exposure of the nasal or oral airways on untested patients, compared with 4.3% before the pandemic (P < 0.001). For examinations in the clinic, 100% reported wearing a mask during the pandemic compared with 40.3% before the pandemic (P < 0.001). After the pandemic is over, 31.9% of surgeons planned to continue using an N95 mask or powered air purifying respirator for craniofacial cases and 80.9% planned to continue using masks in clinic. Overall, 46.8% of respondents believed that N95 masks should be the standard for craniofacial surgery.

Conclusions: The COVID-19 pandemic has significantly shifted the practices and opinion of craniofacial surgeons toward more protective personal protective equipment. These results indicate that this is likely to persist after the pandemic is over, which may limit surgeon exposure to airborne disease and help the field withstand future epidemic outbreaks. (Plast Reconstr Surg Glob Open 2021;9:e3686; doi: 10.1097/GOX.0000000000003686; Published online 22 June 2021.)

INTRODUCTION

A novel coronavirus strain, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), that was first identified in late 2019 has caused a worldwide pandemic known as coronavirus disease 2019 (COVID-19). As of April 2021, SARS-CoV-2 has infected over 140 million people, resulting in over 3 million deaths, creating a global healthcare crisis not seen since the Spanish flu pandemic of 1918. The COVID-19 outbreak has had a tremendous impact on hospital-based healthcare in the United States, with the Center for Medicaid Services issuing a statement recommending the delay of elective operations for some period of time during the pandemic due to concerns about limited essential medical resources. Furthermore, the COVID-19 pandemic has raised concerns in the medical community about exposure risk to SARS-CoV-2 as more data are made available regarding pulmonary complications and long-term neurologic sequela associated with the disease.

Those healthcare providers who work in close proximity to the aerodigestive track are at particularly high risk. Studies have shown that viral loads of SARS-CoV-2 are highest in the pharynx and upper aerodigestive tract and transmission is well-documented through aerosolized
METHODS

A survey study was conducted of active members in the American Society of Craniofacial Surgeons (ASCFS), consisting primarily of practicing surgeons in the field of craniomaxillofacial surgery. The survey consisted of 17 required questions regarding their preference of personal protective equipment (PPE) use before, during, and after the pandemic in patients with or without COVID-19 infection, as well as eight required demographic questionnaires (Table 1). The survey instrument was distributed by email to qualifying members, and survey responses were collected over a 2-month period from June 4, 2020 to August 4, 2020. Qualifying members included practicing craniomaxillofacial attending surgeons who met the criteria for ASCFS active membership (Table 2). Email rejections or error messages were excluded from the study. Survey responses were gathered anonymously with the option of providing contact information to be used only for drawing a gift card incentive. Survey data were collected in spreadsheet format and analyzed using Microsoft Excel (Microsoft Corp, Redmond, Wash.). Question responses were sorted by demographic information such as practice type, location, age, and gender. Respondents who did not actively practice craniofacial surgery were excluded from analysis. Statistical analysis was performed utilizing two-tailed Fisher’s exact tests in GraphPad Prism (GraphPad Software, La Jolla, Calif.) and Microsoft Excel (Microsoft Corp, Redmond, Wash.). Statistical significance was set at the conventional standard of a P value less than 0.05.

RESULTS

The survey form was distributed to 296 qualifying member email addresses. Forty-three emails resulted in rejection or error messages, signaling failed receipt of those surveys. Thus, a calculated 253 survey forms were successfully sent. A total of 48 responses were received for a survey response rate of 19.0%.

Table 1. Questions Included in the Study Survey Instrument

<table>
<thead>
<tr>
<th>COVID-19 Practices of Craniofacial Surgeons Questionnaire</th>
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<tbody>
<tr>
<td>Do you regularly perform craniofacial procedures in your practice?</td>
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<tr>
<td>If so, what percentage of your practice consists of craniofacial surgery?</td>
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<tr>
<td>What percentage of your practice consists of surgery involving the exposure of nasal or oral airways?</td>
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<tr>
<td>Before the COVID-19 pandemic, what kind of facial personal protective equipment (PPE) did you use for craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Before the COVID-19 pandemic, what kind of facial PPE did you use for nasal or oral airway examinations in the clinic?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for patients testing POSITIVE for COVID-19 undergoing craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for patients testing NEGATIVE for COVID-19 undergoing craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for patients NOT TESTED for COVID-19 undergoing craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for patients testing NEGATIVE for COVID-19 undergoing craniomaxillofacial procedures NOT involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for patients NOT TESTED for COVID-19 undergoing craniomaxillofacial procedures NOT involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, what kind of facial PPE would you use for nasal or oral airway exams in the clinic?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, are you testing all patients for COVID-19 before treatment?</td>
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<tr>
<td>Currently during the COVID-19 pandemic, would you treat a patient who has NOT BEEN TESTED for COVID-19 with a NON-URGENT craniomaxillofacial procedure involving exposure of the nasal or oral airways?</td>
</tr>
<tr>
<td>Currently during the COVID-19 pandemic, would you treat a patient who has NOT BEEN TESTED for COVID-19 with a NON-URGENT craniomaxillofacial procedure NOT involving exposure of the nasal or oral airways?</td>
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<tr>
<td>After the COVID-19 pandemic, what kind of facial PPE do you plan on using for craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Has the COVID-19 pandemic changed your opinion about what PPE should be used for craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>Should the use of N95 masks be standard for all craniomaxillofacial procedures involving exposure of the nasal or oral airways?</td>
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<tr>
<td>After the COVID-19 pandemic, what kind of facial PPE do you plan on using for nasal or oral airway examinations in the clinic?</td>
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<tr>
<td>Please select the gender you most identify with</td>
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<tr>
<td>What category represents your age in years?</td>
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<tr>
<td>How many years have you been in practice?</td>
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<td>How would you describe your practice setting?</td>
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<td>How would you describe your practice location?</td>
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All but one of the respondents (or 95.6%) were actively practicing craniofacial surgery and thus were included in the analysis. Seventy-two percent of the respondents were men and 27.7% were women. The majority of those surgeons (55.3%) were aged between 35 and 44 years, while 25.5% were between 45 and 54 years, 17% were between 55 and 64 years, and 2.1% were over 65 years. This corresponded to 68.1% of respondents between 0 and 9 years in practice, 8.5% between 10 and 19 years in practice, and 21.3% over 20 years in practice. The survey group consisted of surgeons from a variety of practice settings. These included academic practice (61.7%), employed hospital practice (17%), multispecialty group practice (10.6%), solo private practice (8.5%), and group private practice (2.1%). These practices spanned across several different types of locations in the United States, including 61.7% in large metropolitan areas (population: 1.5 million or more), 25.5% from metropolitan areas (population: 500,000 to 1.5 million), 10.6% from medium-sized urban areas (population 200,000 to 500,000), 2.1% in small urban areas (population 50,000 to 200,000), and none from rural areas (Fig. 1).

Before the COVID-19 pandemic, the vast majority (95.7%) of craniofacial surgeons routinely used standard surgical masks for operations involving exposure of the nasal or oral airways. This has changed dramatically during the COVID-19 pandemic, with only 8.5% of surgeons opting for a standard surgical mask for untested patients ($P < 0.001$). The rest prefer either N95 masks (78.7%) or powered air purifying respirators (PAPR) (12.8%) for personal protection during procedures involving exposure of the airways. These numbers shifted more in favor of PAPR (25.5%) rather than N95 (66%) for patients testing positive for COVID-19. PAPR were generally not used for patients testing negative for COVID-19, but 61.7% still wore N95 masks while 38.3% wore standard surgical masks (Fig. 2). Similar precautions were taken for patients undergoing procedures not involving exposure of the airways. For untested patients, 21.3% wore standard surgical masks, 63.8% wore N95 masks, and 14.9% wore PAPR. For patients testing positive for COVID-19, only 6.4% opted for standard surgical masks, while 74.5% wore N95 masks, and 19.1% wore PAPR. For patients with proved negative COVID-19 tests, 46.8% opted for standard surgical masks and 53.2% wore N95 masks. Of note, 89.4% of respondents routinely tested all patients before an operation and 93.6% of surgeons would only perform nonurgent operations on patients that had been tested for COVID-19.

Since the pandemic, behaviors have also changed significantly with nasal or oral airway exams in the clinic (Fig. 3). Before the rise of COVID-19, 57.4% of surgeons wore no mask in clinic while 40.4% wore standard surgical masks. In the midst of the pandemic, no respondents reported wearing no PPE, while 42.6% opted for standard surgical

Table 2. ASCFS Active Membership Requirements

1. Be a legally qualified, reputable practicing surgeon who is board certified in plastic surgery, active in craniofacial surgery, and who has made worthwhile contributions in this field.
2. Has at least 12 months training in craniofacial surgery at a program recognized by the Society.
4. Has been in active practice of craniofacial surgery for a minimum of 3 years.
5. Board certified by the American Board of Plastic Surgery (ABPS) or the Royal College of Physicians and Surgeons of Canada (RCPSC).
6. Must submit a list of operations performed in 2 consecutive years, which have been approved by the Society. At least 25 of these should have been of the intracranial type.
7. Submit a list of members of your clinical team.
8. Has published at least 2 papers on the subject of craniofacial surgery.
masks, 53.2% elected to wear N95 masks, and 4.3% preferred PAPR. Once the pandemic is over, about 51.1% of surgeons plan to continue using a standard surgical mask in clinic, while 29.8% plan to use an N95 mask, and 19.1% plan to revert back to wearing no mask for nasal or oral airway exams. These reported numbers for mask wearing of any kind during and after the pandemic constitute a stark contrast compared with before the pandemic began ($P < 0.001$).

In the operating room, only 68.1% of surgeons plan on returning to a standard surgical mask for cases involving the airways after the COVID-19 pandemic is over. Compared with only 4.3% before the pandemic, 29.8% of surgeons plan on wearing N95 masks in the operating room after the pandemic is over ($P = 0.001$) and 2.1% would go as far as to wear PAPR as the standard PPE of choice. In fact, 51.1% of craniofacial surgeons reported that the COVID-19 pandemic has changed their opinion on what PPE should be used for craniomaxillofacial procedures involving exposure of the nasal or oral airways.

**DISCUSSION**

The COVID-19 pandemic has undoubtably changed healthcare workers’ perspectives on their susceptibility to contagious airborne diseases and the choice of PPE for...
high-risk operations such as those in craniofacial surgery. The results of this study reflect a clear shift in surgeon preference over the course of this pandemic from less restrictive oral and nasal protection to more protective masks such as N95 or PAPR. These effects are suggested to last beyond the end of this current pandemic according to our respondents, as COVID-19 has served as a strong reminder of the inherent risks of operating around the aerodigestive tract. Demographic breakdowns of these study results have also demonstrated interesting associations amongst craniofacial surgeons. As expected, younger surgeons (those aged 35–44 years) were more likely than older surgeons (45 years and above) to opt for the less-protective standard surgical masks for patients who were untested for COVID (15% versus 0%, \( P = 0.13 \)) and those testing negative in procedures not exposing the airways during the pandemic (62% versus 29%, \( P = 0.039 \)). Additionally, younger surgeons were less likely to change their opinion on PPE choice once the pandemic is over, with significantly more surgeons under 45 years old opting to return to standard surgical masks (\( P = 0.011 \)) and many indicating that N95 masks should not be standard for all procedures with exposure of the airways (\( P = 0.082 \)). This is consistent with recent evidence in the literature indicating that younger patients are less at risk for serious illness and long-term sequelae from COVID-19.\(^{14,15}\) Interestingly, this study also found that younger surgeons were more likely than older surgeons to wear PAPR during the pandemic for patients testing positive for COVID-19 (35% versus 14%, \( P = 0.18 \)), although this difference did not reach statistical significance. This may indicate a trend toward openness to extreme PPE measures in the younger generation or enhanced concern for spread to susceptible family members. Of note, male surgeons were also less likely than female surgeons to use more protective PPE (\( P = 0.049 \)) and less likely to believe N95 masks should be standard for craniofacial cases after the pandemic is over (\( P = 0.020 \)).

Respondents have indicated that hospital policies often dictate their practices, including the requirement to have all patients tested for COVID-19 before elective procedures. Similarly, some medical centers may mandate the use of N95 masks or PAPR for all untested patients undergoing craniomaxillofacial procedures. On the other end of the spectrum, the availability of PPE is variable across practice settings and respondents have indicated that not all hospitals provide PAPR or have sufficient supply of N95 masks during the pandemic. Finally, demographic distribution and response rate limitations are often present with internet-based survey instruments. Although our response rate of 19% is less than typically desired, it is within the predictable range for electronic-based surveys.\(^{16}\) Concerns regarding bias in representativeness due to response-rate limitations were partially mitigated by the use of relatively-stringent invitation criteria consistent with ASCFS active membership requirements, which helped ensure that respondents were from the target expert population. Furthermore, the collection of detailed demographic and practice data allowed us to ensure that the respondent backgrounds were representative of the ASCFS membership and the population of actively-practicing craniofacial surgeons in the United States. Our study results therefore only represent the opinions of craniofacial surgeons in the United States, where the COVID-19 pandemic has been particularly severe, and may not represent the practices of craniofacial surgeons in other regions of the world.

CONCLUSIONS

The COVID-19 pandemic has significantly changed the expert opinion of craniofacial surgeons regarding the use of PPE in their medical practices. Overall, surgeons have shifted en masse to more protective face masks for patients undergoing craniofacial procedures regardless of testing status and for examinations involving the aerodigestive tract during the pandemic. This is likely to endure after the pandemic is over, as approximately half of the craniofacial surgeons believe that the pandemic has changed their opinion on PPE use and that N95 masks should be standard for operations involving exposure of the airways once the pandemic is over. These changes in behavior due to COVID-19 may help limit surgeon exposure to other airborne diseases in the future and help prepare the field for future epidemic outbreaks.

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REFERENCES

2. Centers for Medicare and Medicaid Services. CMS adult elective surgery and procedures recommendations: limit all non-essential planned surgeries and procedures, including dental, until further notice [press release]. April 7, 2020. Available at

Fig. 5. Surgeon responses indicating whether N95 masks should be the standard for all craniomaxillofacial procedures involving exposure of the nasal or oral airways.


