In-hospital 3D Printing to Aid Maxillofacial Surgery during the COVID-19 Pandemic

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Surgeons around the world share the same goal: providing the best care to their patients. In recent years, the complexity of procedures has increased, and so has the need for enhanced planning, training, and education. A growing number of interventionists and surgeons are using 3D-printed patient-specific models in their practice to prepare for procedures with more confidence. In 2018 we considered to implement 3D printing in our hospital, and we have created a virtual planning and 3D printing LAB within the maxillofacial surgery department at Città della Salute e della Scienza Hospital, University of Torino, Italy. (**See Video [online]**, which displays the planning, printing and intraoperative cutting guides.) The laboratory is equipped with a CAD station and two 3D printers (Ultimaker 3 Extended and Formlabs Form 3).

3D-printing and advanced visualization techniques have been proved to assist clinicians develop tailored surgical approaches for patients. Hospitals, clinicians, and patients can all benefit from 3D printing regardless of whether the process is handled in-hospital or outsourced. Nevertheless, having a dedicated facility in-house can cut days off the process, support innovation initiatives, and lower the overall costs incurred by the hospital.

From the beginning of 2019 until the period before the start of the COVID-19 pandemic, the laboratory within the department worked at full capacity for the virtual planning of selected cases and for the printing of models. According to Jacobs and Lin,[1] 3D-printing technologies in cranio-maxillofacial surgery were divided into 4 categories: Type 1 contour models, Type 2 guides, Type 3 splints, and Type 4 implants. In the period between January 2019 and the start of the pandemic, we printed a total of 331 models. In 79 cases, only type 1 models were printed; in 68 cases, type 1 models were printed together with type 2 and 3 models.[2]

At the start of the lockdown, elective surgical activity was drastically reduced, as well as hospital resources. Surgical activity was therefore limited only to handling trauma and tumors. However, the activity of the 3D laboratory has not suffered a limitation: in addition to the planning and realization of the surgical models, the production of protective visors has been started to support the surgical departments of the entire hospital (Fig. 1).

During the period of the lockdown, 650 pieces of personal protective equipment were produced in our 3D laboratory at the Division of Maxillofacial Surgery. The creation of an in-hospital 3D lab has been shown to be an effective tool both for routine surgery and during the pandemic. The ability to customize devices and surgeries proved to be a possibility for the immediate production of emergency devices within the department.

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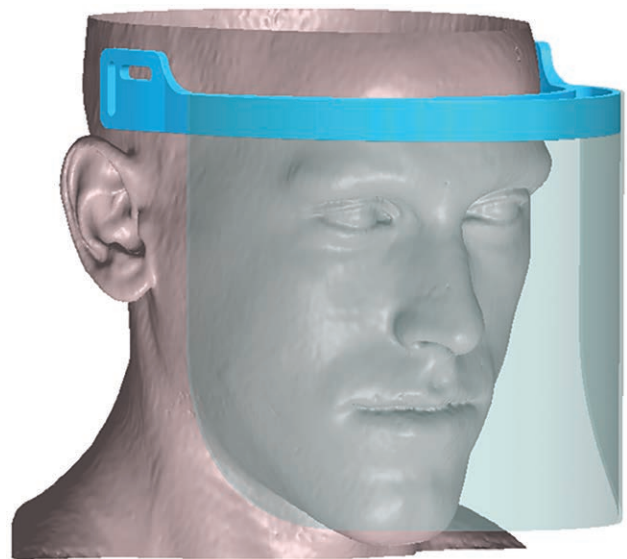Italy
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Fig. 1. Protective visor 3D model to print.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. Jacobs CA, Lin AY. A new classification of three-dimensional printing technologies: systematic review of three-dimensional printing for patient-specific craniomaxillofacial surgery. *Plast Reconstr Surg*. 2017;139:1211–1220.

2. Zavattero E, Fasolis M, Novaresio A, et al. The shape of things to come: in-hospital three-dimensional printing for mandibular reconstruction using fibula free flap. *Laryngoscope*. 2020 Apr 6. doi: 10.1002/lary.28650.