Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the editor

Minimizing infectious spread during fabrication of casts and orthotics for hand fractures in COVID-19 patients

Dear Editor,

COVID-19, caused by infection with the novel coronovirus SARS-CoV-2, is a highly contagious disease, which as of April 30, 2020, had infected 3 million people and caused 217,769 deaths worldwide within a short span of 4 months since the first diagnosis was reported in Wuhan, China, in December 2019 [1]. Its rapid spread across continents led the World Health Organization (WHO) declaring a global pandemic on March 11, 2020. The disease has affected all aspects of healthcare, placed unprecedented acute strain on healthcare systems, utilized immense resources and led to major policy and organizational changes.

The focus of efforts is undeniably concentrated on treatment and supportive care for infected patients. Although the disease primarily affects the respiratory tract, it can deteriorate into pneumonia, acute respiratory distress syndrome and ultimately multi-organ failure. However, patients with COVID-19 can present other concomitant urgent conditions such as trauma and surgical and oncologic emergencies.

COVID-19 – positive patients with hand fractures, among other conditions, are referred to the Hand and Reconstructive Microsurgery unit in our hospital. Internationally, surgeons have limited the possible indications for surgery, decreased clinic visits and proposed alternatives to surgery [2]. Conservative treatment of fractures in COVID-19 – positive patients increased due to resource constraints coupled with surgeon and patient preferences [2]. Thermoplastic splints and casts serve as a valuable treatment modality to maintain fracture reduction and provide temporary immobilization. Other advantages are being simple to apply, accommodate swelling, allow for protected movement, and hygiene. Such splints and casts are also an option for patients unable to tolerate casting due to wounds or skin sensitivity.

However, the option of conservative treatment does not eliminate occupational health risk because the healthcare provider still comes into contact with the patient for a substantial amount of time to administer treatment and rehabilitation. This contact risks prolonged exposure to COVID-19 spread by droplet transmission and interaction at close proximity. Cautionary guidelines were published for trauma surgeons operating on COVID-19 – positive patients [3], but less attention is given to similar guides addressing conservative management of fractures targeted at physicians and therapists caring for these patients. Although the International Society for Prosthetics and Orthotics guidelines provide a useful reference for outpatients attending prosthetics and orthotics clinics during the pandemic [4], a gap in knowledge remains regarding bedside casting and splinting workflows for the COVID-19 – positive patient.

To minimize occupational health risks due to infective transmission from a COVID-19 – positive patient, we describe our experience with thermoplastic splint fabrication for conservative treatment of hand fractures in COVID-19 – positive patients in a tertiary care hospital. We also give practical tips for physicians and therapists involved in the care of this specific group of patients, in particular how to minimize interaction exposure time and reduce difficulties during the splint fabrication process.

The highly contagious spread of COVID-19 is postulated to be through droplet spread, and the WHO recommends airborne, droplet and contact precautions [5]. The particle size is estimated at about 0.125 μm (125 nm, range 0.06–0.14 μm) [2] and the viral burden may remain aerosolized in the air for 3 hr and on surfaces for up to 48 to 72 hr [6]. Contamination of the face, skin and mucosa is to be avoided. Hence, personal protective equipment (PPE) with gowns, gloves, N95 masks, face shields or goggles and surgical caps or hoods are recommended protection for prolonged close contact in hospitals [5]. Patients with suspected or confirmed COVID-19 should wear a mask as well [7].

Training in PPE donning and doffing and observing hand hygiene is essential for reducing the infection risk and preventing self-contamination. Healthcare workers contracting COVID-19 comprise 9% to 16% of all cases [8]; 20% of frontline healthcare workers are predicted to become infected [9,10]. Despite variations in the types of PPE used and the re-gowning frequency, the proportion of infected healthcare workers is low with strict PPE procedures [11]. Hence, appropriate PPE is essential during patient interaction time so as to reduce occupational health risks. A protective gown, gloves, N95 mask, surgical cap and eye shields are worn during patient interactions. Our hospital adopted coronavirus testing of medical staff who are ill with fever or respiratory symptoms after interaction with positive and suspected COVID-19 – positive patients, mandating compulsory medical leave for 1 week. This protocol allows staff to be confident of their diagnosis and ensure safety of other staff and patients.

The patient with COVID-19 is lodged in an isolation ward or may be housed with other COVID-19 – positive patients in a COVID-19 – positive cohort ward. Moving or transporting patients outside their assigned areas is avoided.

We prepare a list of the following items that will be needed for the splint/cast fabrication process:

- large plastic basin;
- scissors or shears;
- inner stockinette layer;
- pressure foam, as necessary;
- cleansing wipes;
- patient care instruction sheet;
- pre-molded thermoplastic splint and Velcro straps and hooks to secure the splint or plaster of Paris slab cut and layered within cotton wool and crepe bandage.

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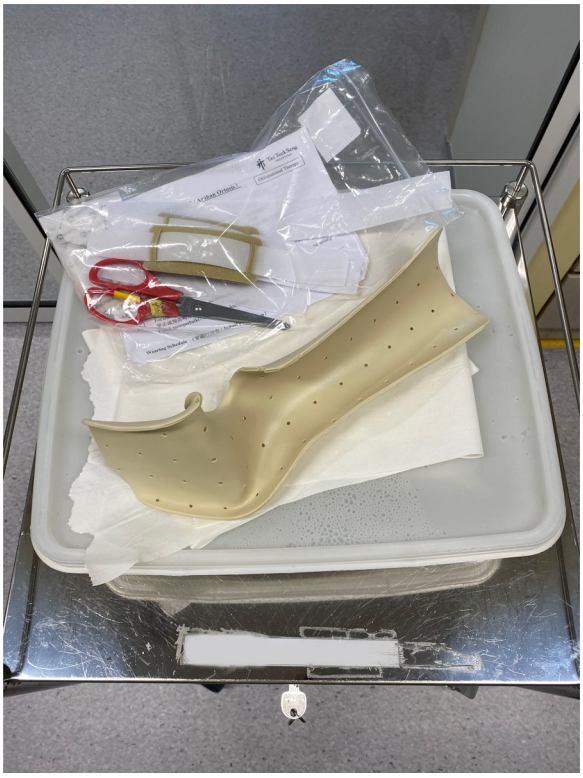

Fig. 1. The pre-molded thermoplastic splint and necessary materials are prepared and brought into the patient's isolation room.

The scissors, Velcro stickers and straps, and the patient care instruction sheet are placed in a clear disposable bag. A square plastic basin measuring about 30 × 30 cm is added and will later be filled with hot water for final molding of the splint at the patient's bedside (Fig. 1).

At the end of the splint fabrication process, the only pieces of equipment we bring out of the room are the basin and scissors. The process of surface decontamination involves using 70% isopropyl alcohol wipes to wipe down the basin and scissors. Kampf et al. demonstrated that a 62% to 71% ethanol concentration was able to reduce SARS-CoV-2 contamination within 1 min of wipedown [12]. For patients placed in a negative pressure isolation room with an anteroom, the anteroom is suited for proper doffing and decontamination processes. In the absence of an anteroom, the decontamination procedure follows the same process performed at the exit of the patient's cubicle. In the outpatient setting, we follow the same routine of equipment preparation and decontamination when attending to patients at suspected high risk of COVID-19. A separate consultation room and equipment is reserved for these patients, and room surfaces are cleaned by hospital housekeeping after each encounter. Hand hygiene is practiced as a critical step before and after decontamination. A new pair of gloves is worn for the decontamination process.

Although the steps might appear straightforward, experience helped to shape our recommendations. Adequate preparation is crucial to avoid having to enter and exit the patient's room multiple times to retrieve forgotten materials or prolonged unnecessary exposure. Here, we list the steps for the bedside encounter and provide pointers to manage common difficulties that may arise.

The initial preparation may be performed in the therapy department or in a clean area of the ward. The splint made of thermoplastic material of 3.2-mm thickness is first pre-molded outside the patient's room, when no extra precautions are necessary and base materials are easily available. A crucial initial step, and also a common difficulty, is estimating the splint size for a custom fit. The splint is shaped based on an estimate of the patient's physical size, which we obtain by observing the patient from outside the room or from the body mass index estimate by the ward staff. A plaster of Paris slab wrapped in cotton wool can also be prepared outside the room, using estimates in a similar manner. The splint material is pre-molded by shaping it on a model of similar size, and the thumb slots are cut and fashioned. Velcro straps are pre-cut to a suitable length, with some allowance for length adjustments. When the pre-molded splint is completed and necessary equipment and materials are prepared, the physician or therapist is ready to enter the room with the previously listed items.

The basin is filled with hot water as the last step before PPE gowning and entry into the room. As a precaution, we fill only half the basin to avoid spills and burns. A pot of hot water is placed outside the isolation room, in case a top up of hot water is necessary. We have not had instances in which additional hot water was used but continue to practice it in case of unforeseen circumstances. The basin with hot water is placed at the bedside on the cardiac table. A small trolley can be used to hold the basin and splint or cast equipment if there are no tables in the patient's room.

Attention is paid to the patient's skin condition for wounds and hygiene. The patient's hand is cleaned with cleansing wipes and fitted with the stockinette, and pressure foam is stuck over pressure points. The pre-molded splint is fitted onto the patient and the areas for modification are noted. The splint is dipped into the basin of hot water and the ill-fitting areas are refashioned. The patient is fitted again. This molding process is repeated until the desired splint fit is achieved and conforms to the patient's dimensions. Excess splint material is cut off with scissors. The Velcro straps and hook adhesives are then applied onto the splint and trimmed to the correct length. We recommend bringing an extra pair of Velcro straps and self-adhesive Velcro hooks. The patient care information sheet is explained and left with the patient. The basin is emptied into the sink within the patient's room. Only the basin and scissors are brought out of the patient's room.

This method of pre-molding minimizes the total time taken to complete a cast or splint as compared with the normal practice of fabricating one from scratch in the presence of the patient. We are able to keep the total bedside contact time with the patient under 10 min to complete the cast or splint. Although the risk of exposure time is largely documented for unprotected healthcare workers, we aim to observe similar recommendations during our procedures and maintain it to less than 30 min. The entire process is smooth and is sufficiently straightforward to be replicable in other bedside settings.

We practice deferring non-urgent rehabilitation needs during this period, but patients with fractures or other acute injuries and those under prolonged immobilization require initiation of neuromuscular rehabilitation to preserve active and passive motion as well as muscle strength and to reduce limb edema and deep vein thrombosis. In these situations, the same precautions for contact and appropriate PPE apply. We limit therapy to the bedside for inpatients and within a reserved consultation room for outpatients. Decontamination of equipment and surfaces follow the steps discussed earlier.

Most patients will be able to cooperate with the splint fabrication process and follow instructions provided by the physician and therapist. However, some patients are older or have difficulty following instructions. They may not be able to say whether the molded splint temperature is too high during fitting or learn how to care for splints or hand hygiene. The usual caregiver is

not present because most hospitals have barred visitors. Therefore, we must ensure a good splint fit if the patient is not communicative. The role of hand hygiene and care is partly the nurses' responsibility. Communication with the patient's family via teleconferencing is a welcome option to update them on their relative's progress and rehabilitation plans. Post-discharge rehabilitation plans can be conducted via telemedicine means.

We believe that these suggestions can be useful for physicians and therapists caring for patients with COVID-19 to reduce interaction time and risk of disease transmission. The main strategies pertain to the use of PPE and reduction in interaction time and decontamination routine. These suggestions are applicable for not only caring for COVID-19 – positive patients but also for future infectious diseases involving spread by contagious droplets, aerosol and contact.

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Disclosure of interest

The authors declare that they have no competing interest.

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