Endotracheal tube anchoring to the maxilla in an edentulous patient with a facial burn

ABSTRACT
Securing an endotracheal tube for the patients with facial blistering due to burns is problematic. Unstable fixation may cause dislodging of the tube. Various improvements have been reported to overcome this problem. However, they are not considered practical, because all methods require a special instrument, which may be impossible to obtain in emergent situations. In this report, we present a simple and easy technique to directly secure an endotracheal tube to the maxilla. A 64-year-old man sustained a scaled burn involving 10% of the total body surface area to the face and both hands. He also had inhalation injury and underwent immediate intra-tracheal intubation at a nearby hospital. As the patient’s face was covered with blisters, the fixation of the tube to the skin was unstable. Also, the patient had no teeth to fix the tube. Thus, we directly fixed the endotracheal tube to the maxilla. A drill hole was made in the alveolar process of the maxilla using a Kirschner wire and hand-hold drilling instrument, and a nylon line was threaded through the hole and tied around the endotracheal tube. The tube was anchored securely until extubation for seven days. We describe a simple method to secure an endotracheal tube to the maxilla in a toothless patient who sustained facial burn, without any special instruments. Our procedure may be a favorable option for such patients who require immediate oral intubation.

Keywords: Emergent intubation, endotracheal tube fixation, facial burn, inhalation injury, maxilla, toothless

INTRODUCTION
Inhalation injury, which is usually associated with a facial burn, often causes edema of the upper airway and requires endotracheal intubation.[1,2] As a displaced endotracheal tube causes a respiratory disturbance, the rigid fixation is indispensable. Furthermore, it may be impossible to reposition the tube during the acute edematous phase of an inhalation injury.[3]

When the burn involves facial skin, fabric tape fixation to the face is not ideal because the tape cannot adhere to the burn wound surface. In such cases, endotracheal tube fixation to the teeth with a dental wire is recommended. However, if a patient with a severe facial burn and inhalation injury, which requires emergent endotracheal intubation, has no teeth to fix the tube, what should we do?

We present such a case and solve the problem using a technique to rigidly secure the endotracheal tube to the maxilla directly.

CASE REPORT
A 64-year-old male sustained a scaled burn with hot oil while repairing a car. He was also exposed to a hot gas, which caused inhalation injury.

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The patient was taken to a nearby hospital and underwent intratracheal intubation immediately and was then transferred to our emergency unit.

At the first examination, the patient had sustained superficial dermal burns to the face and neck and deep dermal burns to both the hands, as shown in Figure 1. His nasal and oral cavities were soot stained, and bronchoscopic examination revealed bronchomucosal abnormalities, including adhesion of soot, mucous exudate, and edema, which suggested that he required prolonged breathing support via an endotracheal tube. On arrival, the inserted end tracheal tube was stabilized with a strip of adhesive tape that encircled the endotracheal tube and was attached to both cheeks. The airway edema was already so severe that we thought the changing to nasal intubation was dangerous. Although tracheostomy is a good option, it was abandoned in consideration of wound infection because there is a burn wound on the neck. Regrettably, as the patient’s face was covered with blisters, the tape could not adhere to the wound surface, and consequently, the fixation of the tube to the skin was unstable. In such a case, we usually anchor the endotracheal tube to the patient’s teeth with the dental wire. However, the patient had no teeth to fix the tube. Thus, we fixed the endotracheal tube to the maxilla directly.

Surgical technique
This procedure was performed under local anesthesia. A drill hole was made in the alveolar process of the maxilla at the position the lateral incisor would be using a Kirschner wire (φ 1.0 mm) and hand-hold drilling instrument [Figure 2]. The drill hole must penetrate from the alveolar surface to the oral cavity. A 2/0 monofilament nylon line was threaded through the hole and was tied with the endotracheal tube [Figure 3].

Tangential excision and thin thickness free skin graft for both dorsal hands were carried out on the 3rd day. Seven days after the injury, the injured bronchial mucosa had healed, and extubation was performed.

The grafted skin took favorably, and residual burn wounds had resurfaced spontaneously within 10 days. Three weeks after the injury, the patient could be discharged from the hospital and returned to work without sequelae.

DISCUSSION AND CONCLUSION
Smoke inhalation injuries, which are usually associated with facial burns, are the leading cause of fatalities from burn injuries. The first priority in the management of inhalation injury is the prevention of acute upper airway obstruction by tracheal intubation, and then, respiratory failure is treated with assisted ventilation because the major
forms of inhalation injuries are injuries to the upper airway and pulmonary parenchymal damage.\textsuperscript{1,2,4} As a displaced endotracheal tube causes a respiratory disturbance, rigid fixation is indispensable. Furthermore, it may be impossible to reposition the tube during the acute edematous phase of an inhalation injury.\textsuperscript{3} When transnasal intubation is initially performed, an endotracheal tube can be firmly anchored to the nasal septum. However, in the case of emergent intubation, the endotracheal tube is inserted through the oral cavity and is stabilized with a strip of the adhesive tape to both the cheeks. This procedure of fixation cannot be chosen when patients suffer from severe facial injuries such as facial burns. In these cases, the endotracheal tube can be fixed to the teeth with wire or orthodontic brackets instead of fixing to the skin.\textsuperscript{1} However, our patient had no teeth to support the intubated tube.

Several investigators have demonstrated favorable strategies to stabilize an endotracheal tube in patients with inhalation injuries and facial burns. Rooney and Poolacherla presented a technique for endotracheal tube fixation using a nasal bridle for a child with facial blistering secondary to toxic epidermal necrolysis.\textsuperscript{5} Hansen and Remensnyder used an external cranial device for endotracheal tube fixation.\textsuperscript{6} Fleissig \textit{et al.} and Davis described a method to secure an endotracheal tube in such patients by means of an intermaxillary fixation screw. They reported that dental wires are fixed securely to the tube and are then attached to two screws placed in the alveolar process of the maxilla. However, with this method, the screw head may cause ischemia of the mucosa and be a potential source of sepsis because the inserted screw itself is a foreign body.\textsuperscript{3,7} All these unique ideas may provide ridged and stable fixation of the tube. However, they are not considered practical in emergency units because every method requires some special instrument, such as a nasal bridle, external cranial device, and intermaxillary fixation screw, all of which are not commonly available. On the other hand, our method requires only a Kirschner wire, hand drilling instrument, and nylon thread, which are usually available in every operating room. Furthermore, our method takes only 5 min to apply without the need for general anesthesia and can be removed on the ward.

**CONCLUSIONS**

We present a simple method to secure the endotracheal tube in the patient with severe facial burns. Our procedure may be a favorable option for such patients who require immediate oral intubation.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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