

Case Report

## A Case of Toothbrush Trauma Removed in the Awake State and Healed without Complications

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### SUMMARY

Toothbrush trauma is a condition often encountered in the emergency department, sometimes resulting in serious complications requiring appropriate treatment. We present the case of an 11-year-old boy who visited the emergency department with a toothbrush inserted in the left palatal arch. Contrast-enhanced CT was performed to confirm that the tip of the toothbrush had not reached the carotid artery, skull base, or cervical spine and predict any secondary damage after the removal. Local anesthesia was administered by submucosal injection, and the toothbrush was manually removed with the patient in the awake state. After removal of toothbrush, the patient was hospitalized. Then, dietary control was started, and antibiotics were administered to prevent wound infection. He was discharged at 5 day after injury and observed for 14 days to rule out stenosis of the internal carotid artery. The wound healed without any complications. In cases of a toothbrush penetrating the pharyngeal space, it is, therefore, necessary to select an appropriate removal method after predicting the complications caused by removal. The post-removal treatments should be considered to avoid complications such as uncontrolled bleeding, infection, and internal carotid artery stenosis.

**Keywords** : deep cervical abscess, internal carotid artery injury, emergency department, prophylactic antibiotics, otolaryngologist

### INTRODUCTION

A toothbrush is a tool used by people worldwide in their daily lives to maintain oral hygiene. Although not widely recognized, toothbrushes can accidentally damage the oral and pharyngeal mucosa causing vari-

ous complications, especially when penetrating the pharyngeal space<sup>1,2)</sup>. The complications range from mild (pain and controllable bleeding) to severe (infections, airway obstruction, uncontrolled bleeding, and neurological deficits)<sup>1,2)</sup>. Therefore, in such cases, treatment based on a detailed evaluation of the pathological condition while considering the complications after removal is required<sup>3~5)</sup>.

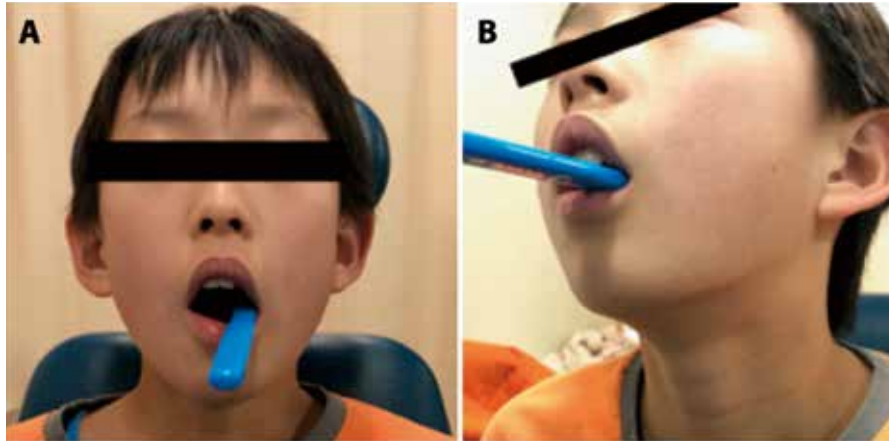
This report describes a toothbrush trauma case wherein the toothbrush had penetrated the parapharyngeal space. Contrast-enhanced CT was performed before removing the toothbrush to predict secondary damage following the procedure, and the toothbrush

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**Figure 1** The patient at the first visit.

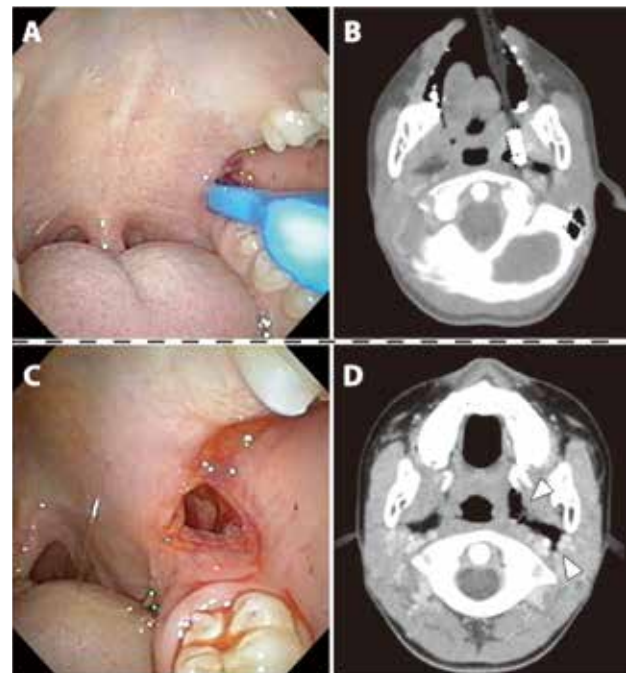
- (A) The toothbrush was fixed in the oral cavity of the patient in an awake state.  
 (B) No penetration of the toothbrush over the neck.

was removed with the patient awake. As a result of the appropriate post-removal treatment, the wound healed without any complications. In addition to the detailed treatment progress of this patient, we have also reviewed the literature on the treatment strategies for toothbrush trauma.

### CASE PRESENTATION

The patient was an 11-year-old boy. He was focused on a tablet device while brushing his teeth and inadvertently hit his foot on his elbow, causing the toothbrush to pierce through his pharynx. His mother tried to remove it at home but could not due to unbearable pain, and brought him to the emergency department. At the emergency department, the toothbrush was found to be fixed in the oral cavity. He was conscious with no respiratory distress, headache, or trismus. The toothbrush had not penetrated over to the neck (Fig. 1A, B). However, it had pierced his left palatal arch, and the tip was buried, which could not be confirmed. There was no arterial bleeding, and the wound was easily observable (Fig. 2A). Prior to removing the toothbrush, the position of its tip was evaluated by contrast-enhanced CT. The toothbrush tip was located in the left parapharyngeal space and had not reached the carotid artery, spine, or skull base. Hematoma formation was not observed (Fig. 2B).

Because the patient could stay still and the possibility of bleeding due to carotid artery damage associated



**Figure 2** Oral and contrast-enhanced CT findings after the injury and removal.

- (A) The toothbrush penetrated the left palatal arch, while its tip could not be confirmed. (B) Contrast-enhanced CT shows that the toothbrush tip is located in the left pharyngeal space and did not reach the carotid artery. (C) Just after the removal, the wound was open without bleeding. (D) Contrast-enhanced CT was performed again just after the removal, showed no hematoma formation in the deep neck and no residual toothbrush. The arrowhead indicates emphysema in the left parapharyngeal space.

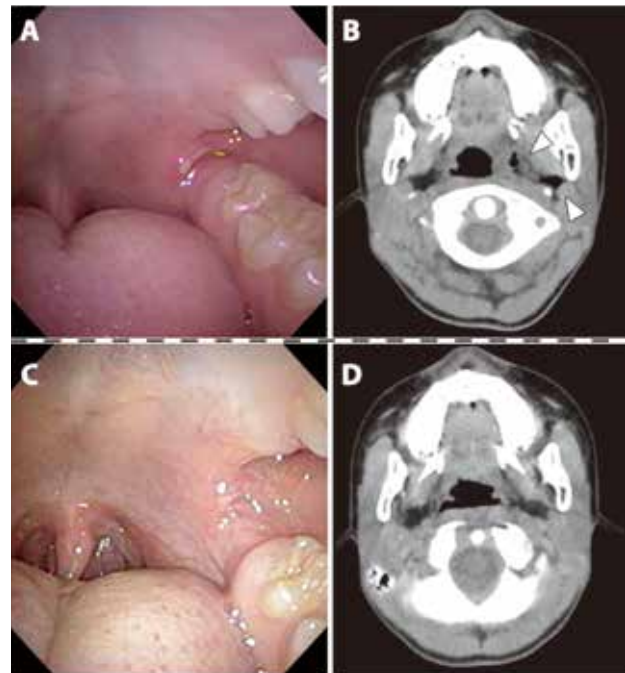


**Figure 3** Extracted toothbrush.

The toothbrush was removed without any damage or residue.

with the removal was low, we decided to remove the toothbrush in the awake state under local anesthesia. After administering a submucosal injection with 1 mL of 1% lidocaine (Xylocaine®) and 1 : 100,000 epinephrine as local anesthesia, the toothbrush was manually pulled out parallel to the insertion direction. The pain was tolerable, and the toothbrush was removed relatively easily. There was no arterial bleeding from the wound just after the removal (Fig. 2C). Contrast-enhanced CT was performed again and confirmed that there was no hematoma and toothbrush residue (Fig. 2D). The extracted toothbrush showed no damage (Fig. 3). After the toothbrush was removed, the patient was hospitalized, managed to prevent infections, and observed for bleeding and neurological deficits.

After admission, the patient had to fast to prevent food invasion into the wound. Rehydration, ceftriaxone (CTRX) 1 g once a day, and clindamycin (CLDM) 300 mg thrice a day were administered intravenously. Two days after the injury, scarring closure of the wound (Fig. 4A) and reduction in emphysema were confirmed by CT (Fig. 4B), and the oral intake of a paste meal was started. After reverting to a regular diet, we confirmed no infections or neurological deficits. With explanation regarding the possibility of new complications to the patient's family, the patient was discharged four days after the injury. From discharge to the seventh-day post-injury, cefcapene pivoxil (CFPN-PI) 270 mg and CLDM 150 mg were orally



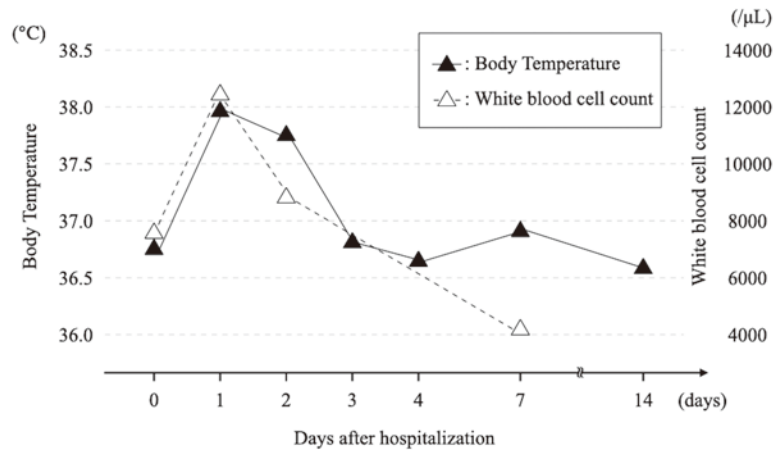
**Figure 4** Oral and CT findings in the healing process.

(A) Two days after the injury, scarring closure of the wound was confirmed, and oral intake of soft food was started. (B) Reduction in emphysema (arrowhead) and no abscess were confirmed. (C) On the 14th day after the injury, the wound was completely closed. (D) The emphysema had disappeared completely.

administered three times a day. On the 14th day post-injury, we confirmed the wound closure and disappearance of cervical emphysema (Fig. 4C, D), and the outpatient examination was completed. The changes in body temperature and serum white blood cell counts were used as signs of infection along with macroscopic findings and CT examination. His body temperature and blood white blood cell count were elevated one day after the injury. The body temperature remained below 37°C after the third day and the white blood cell count was within the normal range on the seventh day post-injury (Fig. 5).

## DISCUSSION

A toothbrush is routinely used worldwide for cleaning the oral cavity. If not used carefully, toothbrushes can damage the oral mucosa, pierce the deep neck, penetrate the skull base and cervical spine, and cause aspiration. These accidents can sometimes cause fatal complications requiring prompt and appropriate action<sup>1~5)</sup>.



**Figure 5** Transition of body temperature and white blood cell counts

Depending on the depth and orientation of the inserted toothbrush, it can damage the oropharyngeal mucosa, deep cervical soft tissue, macrovasculature, skull base, and central nervous system<sup>4</sup>. Removal of the toothbrush without prior evaluation can lead to severe complications such as uncontrolled bleeding, cerebrospinal fluid (CSF) leakage, and residual foreign body; therefore, the location of the toothbrush must be evaluated prior to its removal<sup>6</sup>. Many case reports have suggested the necessity for evaluation by CT before removal, and evaluation by contrast-enhanced CT is necessary to confirm the positional relationship with the macrovasculature<sup>4,7</sup>. If a macrovascular or skull base injury is detected, in addition to removal under general anesthesia, treatment by a vascular surgeon or neurosurgeon is also required<sup>4,8</sup>. However, if these severe complications are absent during removal, the toothbrush could be removed under local anesthesia<sup>3</sup>, considering the difficulty of mask ventilation in the presence of a foreign body in the mouth<sup>9</sup> and the complications of general anesthesia<sup>10</sup>. As in this case, since the tip of the toothbrush did not reach the skull base or carotid artery, and the risk of complications due to removal seemed low, and it could be safely removed with the patient staying awake.

In addition to the complications caused by the toothbrush removal, whether the patient can stay still during the removal is also an essential factor determining anesthesia management. Removal under local anesthesia is possible if the patient is cooperative<sup>3</sup>; however, if the patient is young and cannot be maintained to stay still, removal under general anesthesia

is considered<sup>4</sup>. In this case, the child was 11 years old and understood the need to maintain staying still, and hence, the toothbrush could be removed with local anesthesia. However, there have been reports of toothbrush penetration in patients of similar age, where the removal was performed under general anesthesia<sup>2,3</sup>. It is, therefore, necessary to choose an appropriate anesthesia management method depending on the patient's status.

Even after the toothbrush has been removed safely, post-removal complications must be considered, the most common being wound infection<sup>2</sup>. Emphysema caused by toothbrush insertion and oral bacteria that adhere to the toothbrush can cause infection<sup>11</sup>. The infection is often treatable but sometimes results in inducing an abscess<sup>1,5</sup>. However, the abscess, if not controlled, can spread to the parapharyngeal space and mediastinum, leading to fatal complications<sup>1,3</sup>. Prophylactic antibiotic is recommended because of the high frequency of wound infections in toothbrush trauma cases<sup>12,13</sup>. These include clindamycin, cepheims, and sulbactam/ampicillin, which cover oral bacteria<sup>14,15</sup>. Although there is no consensus on the duration of antibiotic administration, clinical reports have used them for 5–7 days<sup>1,5</sup>. In this case, clindamycin and cepheims were administered for one week to avoid abscess formation.

In addition to prophylactic antibiotics, control of dietary intake is also necessary to prevent wound infection. If the wound is open, oral food intake can cause invasion of foreign matter and oral bacteria to the wound. Therefore, it is recommended to avoid



food intake or eat soft foods for several days after the injury<sup>12)</sup>. In this case, besides the prophylactic administration of antibiotics, dietary intake was prohibited for two days post-injury. From the third day post-injury, the intake of a soft diet was administered considering physical irritation to the wound, and the standard diet was gradually resumed. Such dietary management might help wound healing in cases with open wounds caused by toothbrush trauma.

Internal carotid artery stenosis and neurologic deficit are severe complications associated with toothbrush trauma<sup>16,17)</sup>. Internal carotid artery stenosis occurs when the intima of the blood vessel is damaged by compression of the inserted toothbrush leading to thrombus formation, cerebral infarction, and cerebral ischemic attack, causing neurological deficits<sup>17)</sup>. In some cases, internal carotid artery stenosis develops several days after the injury, requiring emergency surgery and administration of thrombolytic agents<sup>16,17)</sup>. Therefore, careful follow-up for at least three days is required to exclude internal carotid artery stenosis, even in the absence of neurological deficits<sup>3,13)</sup>. In this case, after five days of hospitalization, the patient was followed up for two weeks with sufficient explanation of internal carotid artery stenosis to the family.

### CONCLUSION

We have reported a case of toothbrush insertion in the pharyngeal space, the course of treatment, and outcomes without any complications. Our findings demonstrate the importance of selecting a safe removal method after evaluating the toothbrush tip's position by contrast-enhanced CT. After the removal, an appropriate treatment strategy is necessary considering wound infection and internal carotid artery stenosis to prevent complications.

### Informed consent

The Patient and his family approved the publication of this case report and any images.

### Disclosure Statement

No authors have any conflict of interest in this case report. This case report was not supported by any grant.

### Author Contributions

Akimitsu Iwasaki : Concepting this case report,

Kosuke Tochigi : Concepting this case report and wrote the first draft of this paper, Akiko Umibe, Yoshikata Nishijima, Utaro Anazawa : Editing and revised this manuscript.

Ryohei Akiyoshi, Kazuhiro Omura : Concepting this case report and revised this manuscript. Yasuhiro Tanaka : final editing this manuscript.

### References

- 1) Kumar S, Gupta R, Arora R, et al : Severe oropharyngeal trauma caused by toothbrush—case report and review of 13 cases. *Br Dent J* **205** : 443–447, 2008.
- 2) Sasaki T, Toriumi S, Asakage T, et al : The toothbrush : A rare but potentially life-threatening cause of penetrating oropharyngeal trauma in children. *Pediatrics* **118** : e1284–1286, 2006.
- 3) Ebenezer J, Adhikari DD, Mathew GC, et al : An unusual injury from a toothbrush : A case report. *J Indian Soc Pedod Prev Dent* **25** : 200–202, 2007.
- 4) Umibe A, Omura K, Hachisu T, et al : Life-threatening injury caused by complete impalement of a toothbrush : case report. *Dent Traumatol* **33** : 317–320, 2017.
- 5) Yamada M, Hino S, Nakamura S, et al : Accidental oral injuries by electric toothbrush : a report of three cases. *Case Rep Dent* 2020. <https://doi.org/10.1155/2020/8819850>.
- 6) Soose RJ, Simons JP, Mandell DL : Evaluation and management of pediatric oropharyngeal trauma. *Arch Otolaryngol Head Neck Surg* **132** : 446–451, 2006.
- 7) Uchino H, Kuriyama A, Kimura K, et al : Accidental oropharyngeal impalement injury in children : a report of two cases. *J Emerg Trauma Shock* **8** : 115–118, 2015.
- 8) Zhang D, Chen J, Han K, et al : Management of Penetrating Skull Base Injury : A Single Institutional Experience and Review of the Literature. *Biomed Res Int* 2017. <https://doi.org/10.1155/2017/2838167>.
- 9) Weiss M, Engelhardt T : Proposal for the management of the unexpected difficult pediatric airway. *Pediatr Anesth* **20** : 454–464, 2010.
- 10) Murat I, Constant I, Maud'huy H : Perioperative

- anaesthetic morbidity in children : a database of 24,165 anaesthetics over a 30-month period. *Pediatr Anaesth* **14** : 158-166, 2004.
- 11) Quirynen M, De Soete M, Pauwels M, et al : Bacterial survival rate on tooth and interdental brushes in relation to the use of toothpaste. *J Clin Periodontol* **28** : 1106-1114, 2001.
  - 12) Kupietzky A : Clinical guidelines for treatment of impalement injuries of the oropharynx in children. *Pediatr Dent* **22** : 229-231, 2000.
  - 13) Randall DA, Kang DR : Current management of penetrating injuries of the soft palate. *Otolaryngol Head Neck Surg* **135** : 356-360, 2006.
  - 14) Stevens DL, Bisno AL, Chambers HF, et al : Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections : 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis* **59** : e10-52, 2014.
  - 15) Altieri M, Brasch L, Getson P : Antibiotic prophylaxis in intraoral wounds. *Am J Emerg Med* **4** : 507-510, 1986.
  - 16) Sidhu MK, Shaw DW, Roberts TS : Carotid artery injury and delayed cerebral infarction after minor pharyngeal trauma. *AJR Am J Roentgenol* **167** : 1056, 1996.
  - 17) Moriarty KP, Harris BH, Benitez-Marchand K : Carotid artery thrombosis and stroke after blunt pharyngeal injury. *J Trauma* **42** : 541-543, 1997.