

Original

An investigation of accidental ingestion during dental procedures

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Abstract: Twenty-three cases of accidental ingestion during dental procedures, which occurred at the Center for Dental Clinics of Hokkaido University Hospital between 2006 and 2010, were analyzed retrospectively. We examined not only the objects ingested, but also details of the circumstances (treated teeth, types of treatment, professional experience of the practitioners). Except for two cases (an unidentified endodontic file and the tip of an ultrasonic scaler, which were recovered by vacuuming), the other 21 accidentally ingested objects were all found in the digestive tract, and none in the respiratory tract, by radiographic examination of the chest and abdomen. The ingested objects were mostly metal restorations (inlays or onlays) or prostheses (crowns or cores). Ingestion occurred more frequently during treatment of lower molars, and when procedures were being conducted by practitioners with less than 5 years of experience. No adverse events related to ingestion were reported. The present study found no cases of aspiration or complications related to the ingested objects. However, considering the risk of life-threatening emergencies related to accidental aspiration and ingestion, dentists must take meticulous precautions and be ready to deal with this kind of emergency during dental procedures. (*J Oral Sci* 53, 495-500, 2011)

Keywords: ingestion; foreign body; dental procedure.

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Introduction

Ingestion and aspiration of foreign objects can occur at any time during dental procedures. The results may be life-threatening, and involve damage to the digestive tract, or can be a cause of pneumonia, mediastinitis, peritonitis or sepsis. In some cases, surgical intervention is needed to retrieve such foreign objects. Especially in cases of aspiration, dentists must be alert to the signs and symptoms of airway obstruction and, if necessary, provide immediate and appropriate treatment until the arrival of emergency support. Retrospective and longitudinal studies of accidental ingestion and aspiration in large populations have reported that its incidence is around 0.004%, and that ingestion is more common than aspiration (1,2). The purpose of the present study was to comprehensively investigate accidental ingestion during dental procedures. We analyzed the details of the foreign bodies, the sites and types of dental treatment being performed when the events occurred, details of the professional experience of the practitioners, and the characteristics of the patients. The present findings were also compared with previous reports of ingestion and aspiration of dental components.

Materials and Methods

Cases of accidental ingestion of foreign bodies during dental procedures that occurred at the Center for Dental Clinics of Hokkaido University Hospital between 2006 and 2010 were included in this study. Such accidents occurred in 23 patients (13 male and 10 female) with a median age of 64 y (8-78 y). The protocol of risk management at the Hospital requires the practitioner to call for help and conduct emergency procedures whenever accidental inhalation occurs. For ingestions that do not

Table 1 Cases of accidental ingestion

Case No.	Date	Time	Gender	Age	Object
1	2006-02-14 (Tue)	9:55	M	31	tooth
2	2006-02-14 (Tue)	14:00	M	75	tooth
3	2006-03-23 (Thu)	14:40	F	76	scalertip (outoforal)
4	2006-05-09 (Tue)	11:15	F	60	metal core
5	2006-05-22 (Mon)	14:32	F	63	unidentified (reamer?)
6	2006-06-22 (Thu)	16:15	M	62	orthodontic wire
7	2006-07-21 (Fri)	15:25	F	53	metal inlay
8	2006-09-12 (Tue)	13:40	M	61	metal crown
9	2006-10-05 (Thu)	10:15	M	77	metal inlay
10	2007-07-02 (Mon)	11:30	F	70	bur
11	2007-08-02 (Thu)	16:30	M	70	metal core
12	2007-10-31 (Wed)	14:25	F	60	metal crown
13	2008-01-28 (Mon)	11:30	F	35	metal onlay
14	2008-03-19 (Wed)	13:40	M	78	metal core
15	2008-06-12 (Thu)	10:45	F	64	metal crown
16	2008-07-04 (Fri)	10:10	M	70	bur
17	2008-08-04 (Mon)	10:30	M	73	metal inlay
18	2008-11-27 (Thu)	15:20	M	75	tooth
19	2009-01-16 (Fri)	11:15	M	8	orthodontic lingual arch ST lock
20	2009-06-15 (Mon)	14:58	M	78	scaler tip
21	2009-09-11 (Fri)	11:40	F	47	metal inlay
22	2010-03-26 (Fri)	10:45	M	22	metal core
23	2010-07-05 (Mon)	13:45	F	52	endodontic meter tip

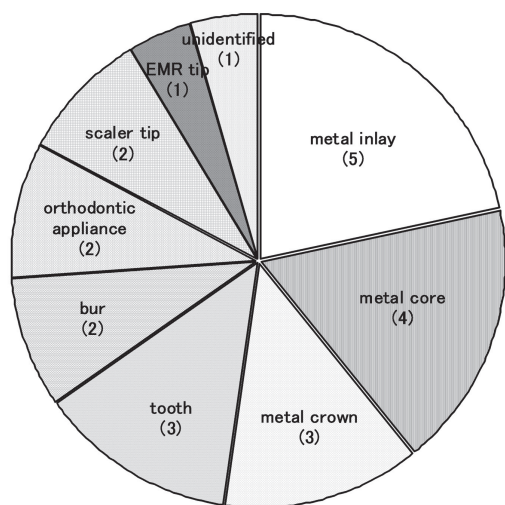


Fig. 1 Objects accidentally ingested.

require urgent treatment, the practitioner informs the risk manager of the department to which he or she belongs, and then the dental radiologist carries out chest and/or abdominal X-ray examinations to establish the location of the inhaled object. When identification of the foreign object is difficult, gastrointestinal barium contrast examination is performed. After identification of the foreign body, careful follow-up observations of potential adverse events and periodic X-ray examinations are essential until the foreign object is egested. The present study investigated the circumstances of accidental ingestions

that occurred at our institution during the last 5 years, and compared and discussed the results with previously reported cases.

Results

There were 23 reports of ingestion, and none of aspiration, during dental procedures in the period covered. Of the patients involved, 13 were male and 10 female, with a median age of 64 y (8-78 y). Among the patients, 5 had cerebrovascular diseases (cerebral infarction in 3, Alzheimer's disease in 1, and Parkinson's disease in 1), 1 had undergone surgery for lower gingival carcinoma, and 1 had maxillary sinusitis. The ingested objects were 5 metal inlays, 4 metal cores, 3 metal crowns, 3 extracted teeth, 2 dental burs, 2 tips of ultrasonic scalers (1 of which was recovered by vacuum suction), 2 orthodontic appliances, 1 electronic root canal measuring tip, and 1 unknown object (Table 1, Fig. 1). The locations of the foreign objects identified by X-ray examination conducted as soon as possible after ingestion were the esophagus in 3 cases, the stomach in 9 (Fig. 2), and the small intestine in 8 (Fig. 3); the location could not be identified in 3 cases. Three of the foreign objects (a bur, a scaler tip, and an endodontic meter tip) were retrieved by endoscopic procedures in view of their sharpness and large size (Fig. 2). Except for these 3 retrieved foreign objects, all the others were egested within 10 days (Fig. 3), and no adverse events related to their ingestion occurred.

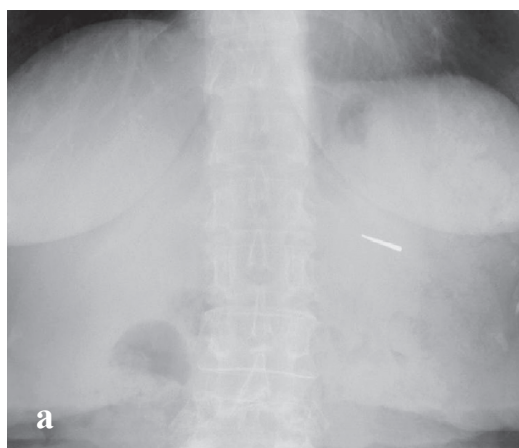


Fig. 2a An ingested bur located in the stomach (case No.10).

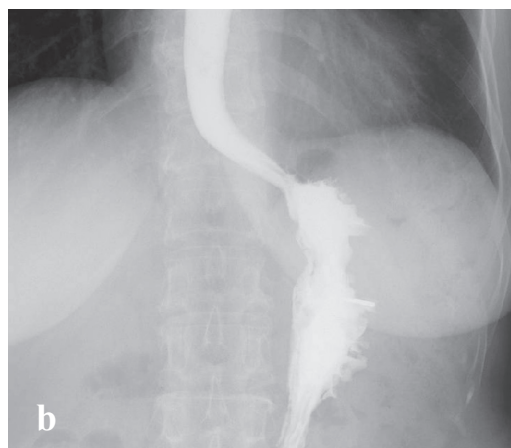


Fig. 2b Gastrointestinal barium examination confirmed the location (gastric corpus) of an ingested bur.

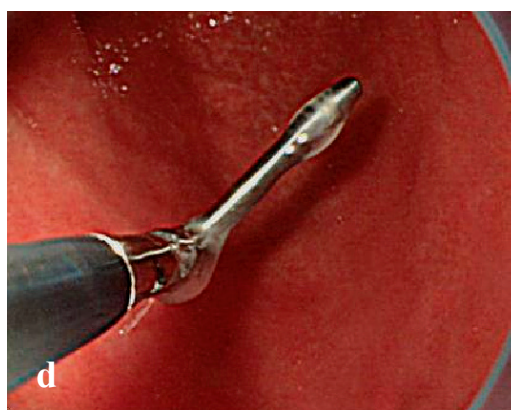
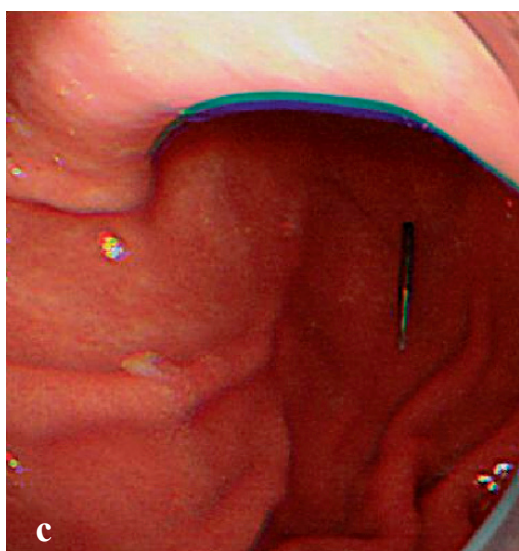


Fig. 2c, d, e Endoscopic procedure was performed to retrieve the ingested bur.

Table 2 The dental procedure at the time of ingestion

Setting/trying In, Cr, Core	8
Removing In, Cr, Core	6
Root canal treatment	3
Teeth extraction	3
Orthodontic procedure	2
Scaling	1

The dental procedure being performed at the time of ingestion was setting/cementing) in 8 cases, removal of inlays, crowns, and cores in 6 cases, root canal treatment in 3 cases, tooth extraction in 3 cases, orthodontic procedures in 2 cases, and tooth scaling in 1 case (Table 2). The teeth being treated at the time of ingestion were 18 lower molars, 7 upper molars, and 6 upper incisors, but no lower incisors (Fig. 4). The professional experience of

the practitioners involved was less than five years in 15 of the cases, between five and ten years in 3, between ten and twenty years in 1, and over twenty years in 4 (Fig. 5). There was no tendency for ingestion to occur at a specific time on a day of the week.

Discussion

Cases of accidental ingestion or aspiration of foreign

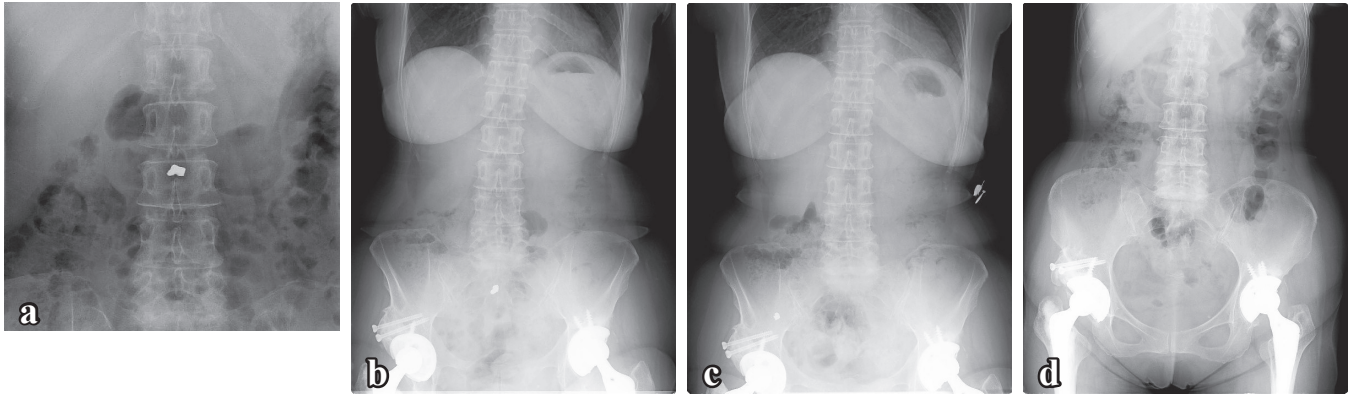


Fig. 3 Posteroanterior abdominal radiographs showing a metal crown (case No.12). a: The metal crown located in the small intestine (jejunum) on the day of ingestion. b: The crown still located in the small intestine (ileum) 2 days after ingestion. c: Passage of the crown to the large intestine (ascending colon) 5 days after ingestion. d: Egestion of the crown 9 days after ingestion.

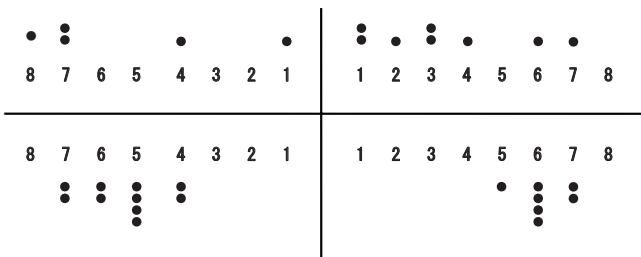


Fig.4 Teeth being treated at the time of accidental ingestion.

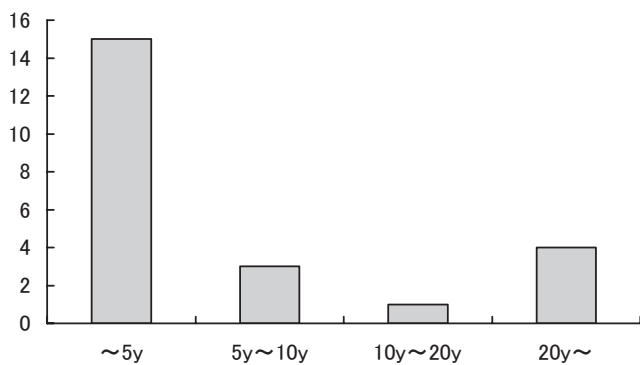


Fig.5 Length of clinical experience of practitioners.

bodies during dental procedures are rare, but the potential consequences can be very serious for the patients involved. Accidental ingestion is more common than aspiration, and usually does not cause any clinical signs or symptoms, most of the foreign objects being egested after passage through the gastrointestinal tract without complications (1-3). Similar to previous reports, the present series included no cases of aspiration, or no severe complications resulting from the reported ingestions. The incidence (cases/patients) of ingestion at our institution was 0.0037% per year. This is comparable to

figures of 0.0041% and 0.0044% reported from different dental college hospitals in Japan (1,2). Moreover, the occurrence (cases/dentists) per year was 0.018, being very close to the figure of 0.021 reported from 2 French insurance companies representing 24,651 French general dental practitioners over an 11-year period (1994-2004) (4). There may be complications such as intestinal obstruction, perforation with subsequent abscess formation, hemorrhage, fistulas, or failure of the objects to progress through the gastrointestinal tract (5). Gastric erosion and perforation of the esophagus caused by ingestion of dental foreign objects have also been reported (3,6). In the present series, 3 cases required esophagoscopy by gastroenterologists, as the foreign objects were sharp or large, thus posing a potential risk of damage and/or obstruction of the digestive tract. Once a foreign object has reached the stomach, there is a greater than 90% chance that it will pass through the gastrointestinal tract as a result of peristaltic movement without complications, usually after a 7-10-day period (7). As a precaution, it is recommended that swallowed foreign objects be assessed by serial radiography until egested. If patients develop symptoms of perforation, such as pain or vomiting, tenderness or abdominal guarding, and if objects remain lodged longer than 2 weeks, surgical intervention is required. Aspiration always requires immediate treatment, as in this setting foreign objects can cause inflammatory reactions or even severe obstruction leading to death (8). If a foreign object is lost into the oropharynx, the patient should be placed in a reclining position, and encouraged to cough vigorously to secure the airway. It is thought that foreign objects are likely to fall into the right bronchial tree because it is oriented more vertically, and in fact clinical data show that such objects become preferentially localized on the right side

(9,10). Symptoms such as choking, inspiratory stridor, and labored breathing are signs of airway obstruction by an aspirated foreign object (11). If further vigorous coughing fails to bring improvement, the Heimlich maneuver should be performed, and attempts made to relieve the laryngeal obstruction (12). This procedure needs to be performed as soon as possible after aspiration, otherwise emergency help must be summoned immediately for transfer of the patient to a hospital emergency unit. Whilst awaiting help, the practitioner and his/her team must consider measures for emergency life support, including airway provision via a cricothyroidotomy, if appropriate and feasible (11). The security manual issued at our institution stipulates that the first step is to immediately call for help from any surrounding personnel, because the practitioner involved in this kind of event is often flustered, and then an emergency team, including an anesthetist, should be called. In this study, the most commonly ingested objects were metal inlays, followed by metal cores and metal crowns, being similar to reports from other institutions (1-3,13). The reason for this may be that some restorative or prosthetic objects are small and slippery, making them difficult to handle manually. This speculation is supported by the fact that many ingestions occurred during procedures involving setting/cementing (8 cases). There were 6 cases of ingestion of metal inlays, cores, and crowns occurring during removal procedures. If detached objects become lost, it is necessary to attempt retrieval with vacuum suction. In this series, we did not experience any cases of ingestion of endodontic reamers or files, despite the non-use of a rubber dam. We speculate that this is because a reamer or file is usually connected to the reamer/file holder of an Electronic apex locator. There has even been a case report of aspiration of a bridge prosthesis composed of 5 crowns during extubation under general anesthesia (14). In the present series, the locations of all ingested objects, except those remaining unidentified or which were recovered outside or inside the mouth, were confirmed by plain X-ray examination. However, in cases of aspiration, lateral X-ray films should also be taken to confirm the location of foreign objects in the respiratory tract. Some objects, (e.g., impression materials or resins) are made of substances that lack radiopacity, making it impossible to identify their position by X-ray, and therefore diagnostic bronchoscopy or computed tomography is necessary for their localization. Physically or mentally disabled persons and children have been reported to be at high risk of foreign object aspiration and ingestion (8-10,15-17). In the present series, 16 among the 23 patients were over 60 years old, 3 had suffered cerebral infarction, 1 had

Alzheimer's disease, 1 had Parkinson's disease, and 1 had undergone surgery for lower gingival carcinoma. Elderly patients may show impairment of sensory and motor nerve responses, which could result in deterioration or dysfunction of the gag/cough reflex. Patients with cerebrovascular diseases may be subject to involuntary movements, and patients with oral cancer who have undergone surgery may have morphological or functional morbidity. In such patients, once foreign objects fall into the oropharynx, they can be easily ingested or aspirated. It has been reported that prisoners, psychotic individuals, alcoholics, mentally disabled individuals, patients who are nervous or restless, and patients with an excessive gag reflex are at high risk of swallowing foreign objects (18). In addition, patients who wear complete dentures ascribed to reduced tactile sensitivity of the palatal mucosa, patients in whom some sites are difficult to access secondary to anatomical restrictions (e.g., a small oral cavity, short palate, macroglossia, or large neck) and those who are barrel-chested, obese or pregnant, in whom increased intra-abdominal pressure is likely, are at great risk of ingesting or aspirating foreign objects (18). It is also thought that ingestion or aspiration of foreign objects tends to occur more often in patients with impaired central nervous system function, which can be influenced by medication with sedatives, tranquilizers, opiates, or depressants (18). In this study, the teeth being treated at the time of ingestion were 18 lower molars, 7 upper molars, and 6 upper incisors; no lower incisors were included. The reason for this appears to be related to the anatomical properties of tooth alignment. Lower molars are closest to the pharyngeal cavity and objects being manipulated in this area may easily be lost. In the treatment of upper molars and incisors, patients are generally forced to lie in a horizontal supine position, which may make it easier for dental objects or instruments to tumble across the tongue dorsum into the pharynx. When treating the lower incisors, fallen or dropped dental objects or instruments would tend to be caught by the oral floor. Dental practitioners with careers shorter than 5 years were more likely to allow accidental ingestion to occur. However, even very experienced dental practitioners can also make mistakes in this respect, suggesting the importance of instituting precautions and countermeasures at all times. A number of methods for preventing aspiration or ingestion have been described. Endodontists encourage the use of a rubber dam during endodontic procedures, both for prevention of ingestion or aspiration as well as for reducing stress arising from safety concerns and improved infection control (4). Other methods including throat packs (gauze throat screens) and retaining ligatures

have been advocated. However, these methods may be uncomfortable for the patients and cannot be used at times of occlusal adjustment. A technique using dental floss that is instantly glued to fixed restorations or knotted to posts and cores has been shown to be simple and cost-effective (19,20). In the treatment of molars, the present authors suggest inclining the head of the patient to one side to help catch objects in the buccal pouch. However, the best countermeasure is still meticulous care to fix burs tightly and to use dental instruments in the properly prescribed way. Additionally, practitioners can make patients aware of the possibility of dental objects dropping in such cases, and instruct them to spit out any dropped objects. Obviously, there is also a need to organize smooth support and cooperative procedures that can be implemented promptly if accidental ingestion or aspiration occurs.

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