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Original Article

Accidental ingestion or aspiration of foreign bodies in the special needs patients during the dental procedures: A retrospective study

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Abstract *Background and purpose:* Accidental ingestion or aspiration of foreign bodies (AIAOFB) is a potential complication during the routine dental procedures, particularly in the special needs patients due to disability and limited cooperation. This study aimed to analyze the prevalence and characteristics of 10 cases of AIAOFB in the special needs patients during the dental procedures from 2011 to 2024.
Materials and methods: This retrospective study reviewed 12 AIAOFB cases occurring either during the dental procedures or outside the dental clinic. These 12 cases were collected from the Oral Health Care Center for Special Needs at National Taiwan University Hospital from 2011 to 2024. Two cases were excluded because the possible ingested objects were not found. The analysis included the nature of ingested objects, dental procedures involved, types of impairment, practitioner experience, and subsequent treatments.
Results: Fortunately, no instance of foreign body aspiration into the trachea or bronchi occurred; all 10 foreign bodies were ingested into the digestive system. Thus, the prevalence of AIAOFB was 0.017 % (10/57,714). Various foreign objects, such as burs and wires, were successfully removed via endoscopic operation. Additionally, the teeth or prosthetic crowns were spontaneously passed through the digestive tract within one to two weeks without complications.

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Conclusion: This study underscores the characteristics of 10 AIAOFB cases in the special needs patients. Vigilance is essential in preventing such incidents, and dentists must be well prepared to promptly diagnose and manage these emergencies when patients inadvertently aspirate or swallow the dental instruments or materials during the dental treatments.

Introduction

Iatrogenic accidents during the clinical procedures are unpredictable and can occur despite all possible precautions.[1] One such complication is the accidental ingestion or aspiration of foreign bodies (AIAOFB) during the routine dental treatments in patients, especially in special needs patients due to their disability and limited cooperation.[2] The dental procedures included root canal therapy, implantation, extraction, and even the routine oral or dental examination. The foreign objects included endodontic instruments, implant components, burs, posts, teeth, orthodontic brackets, restorations, and even dental mirrors and irrigation needles.[3—6] These foreign objects vary in size and shape, including small, large, elongated, round, sharp, and blunt objects, and they can become lodged in either the gastrointestinal or respiratory tract.[1]

Complications arising from ingested or aspirated prostheses and instruments include bowel perforation, abscess formation, obstruction, respiratory compromise, and, in severe cases, death.[7] However, many previous studies stated that in all reported cases, the foreign objects can be excreted uneventfully, only 10—20 % cases needed the nonsurgical intervention, and 1 % or less requires the surgical retrieval.[8,9]

Hou et al. reviewed and analyzed 617 cases of AIAOFB in 45 previously reported articles and found that cases of AIAOFB are rare but risky complications during the dental procedures.[10] They observed that the important variables were often recorded incompletely, including patients' general conditions, procedure locations, the clinical experience of the involved dentists, the tooth position of the procedure, possible causes, and treatments for the AIAOFB. However, these AIAOFB studies included few reports focusing on the patients with special needs. Some other studies discussed these events in individuals with specific disabilities, such as cerebral palsy,[2] developmental disability,[11] and children with autism. It also lacks the comprehensive collection of data and thorough analysis of relevant variables in these AIAOFB cases.

Despite the clinical relevance of the AIAOFB issue, the increased risk of AIAOFB in special needs patients remains underexplored. This study aimed to highlight the prevalence and characteristics of the AIAOFB events while treating the special needs patients. By analyzing these AIAOFB cases collected from an Oral Health Care Center for Special Needs at National Taiwan University Hospital from 2011 to 2024, this study tried to reinforce the importance of preventive measures and emergency management strategies of dental practitioners for these AIAOFB cases.

Materials and methods

Patients

This retrospective cohort study reviewed 57,714 cases of dental treatments for special needs patients in the Oral Health Care Center for Special Needs (established in 2011) at National Taiwan University Hospital from 2011 to 2024. The aim of this study was to investigate AIAOFB events in special needs patients associated with the dental procedures. These AIAOFB incidents occurred either during the dental procedures or outside the dental clinic between 2011 and 2024.

The patients with confirmed foreign body ingestion or aspiration, verified by chest or abdominal radiographies, were included in the study. Those cases in which radiographic evidence was inconclusive were excluded. The collected data included patients' demographic information, types and severity levels of disabilities, the nature of the ingested objects, the dental procedures involved, the clinicians' experiences, and subsequent management strategies for the AIAOFB cases.

Statistical analysis

The data analysis was conducted using the IBM SPSS Statistics Version 21 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographic characteristics. The chi-square test was applied to compare differences between two different groups. A *P*-value of less than 0.05 was considered to be statistically significant.

Results

Prevalence and case confirmation

A total of 12 suspected cases of AIAOFB were identified in the special needs patients between 2011 and 2024. The demographic characteristics of these cases are summarized in Table 1, while distribution patterns and comparative analyses are presented in Table 2.

After radiographic assessment, two cases were excluded because the foreign objects were not detected on the chest and abdominal radiographs. These two undetected objects included a Gates Glidden (GG) drill (Case 6) and a fractured tooth fragment (Case 11). Consequently, 10 cases of confirmed ingestion of the foreign bodies were included in the final analysis, yielding a prevalence rate of 0.00017 (10/

Table 1 Demographics and characteristics of 12 cases of accidental ingestion of foreign bodies.

Case	Year	Gender	Age (year)	Level/Disability	Operator	Condition	Management
1	2012	M	31	Profound/Persistent vegetative state	Resident (4th year)	Extracted tooth	Follow-up and waiting for excretion 2 weeks later (not found in KUB radiograph)
2	2012	M	80	Profound/Dementia, physical disability and Parkinson disease	Senior visiting staff	Fractured tooth fragment due to mouth prop use	The family did not want to check using radiography. (No any other complications later)
3	2013	M	86	Profound/Physical disability and Parkinson disease	Senior visiting staff	PFM crown during crown Removal	Follow up for excretion 1 week later (not found in KUB radiograph)
4[b]	2013	M	36	Profound/Intellectual disability, cerebral palsy and epilepsy	Outside the dental clinic	Gauze for hemostasis after extraction	Found in stool on the next day (reported by the family)
5[b]	2014	F	22	Profound intellectual and physical disability and epilepsy	Outside the dental clinic	Fixation wire with composite resin for tooth subluxation	The wire disappeared from her mouth 2 days later (reported by the family) Endoscopic retrieval on the recall day
6[a]	2014	F	20	Moderate/Intellectual disability and epilepsy	Senior visiting staff	Fractured GG drill	Not found on the chest and KUB radiographs on the same day
7	2017	M	74	Mild/Dementia, Moderate/Physical disability Cerebrovascular disease	Senior visiting staff	Extracted tooth	Found in KUB on the same day and 1 week later Not found in KUB radiograph 2 months later
8[b]	2018	M	66	Profound/Cognition and physical disability, cerebrovascular disease	Outside the dental clinic	Implant-supported crown	Found in KUB radiograph, and follow up for excretion Not found in KUB radiograph 2 weeks later
9	2020	M	55	Profound/Cognition and physical disability, hypoxic-ischemic encephalopathy	Resident (2nd year)	High speed diamond round bur	The bur still at the same site on the KUB radiograph one week later Endoscopic retrieval 12 days later
10[b]	2020	F	89	Profound/Dementia, cerebrovascular disease	Outside the dental clinic	Fractured tooth	Found in KUB radiograph, follow up for excretion
11[a]	2023	F	20	Severe intellectual disability Down syndrome	Senior visiting staff	Extracted tooth	Not found on the chest and KUB radiographs on the same day
12	2024	F	85	Severe dementia Parkinson disease	Junior visiting staff	Low speed white stone bur	Endoscopic retrieval on the same day

Abbreviation: KUB: kidney, ureter, bladder; M: male; F: female; PFM: Porcelain fused to metal.
[a] The foreign object was not found in the body.
[b] The accident happened outside the dental clinic.

Table 2 Distribution and comparison of various parameters in 10 cases of accidental ingestion of foreign bodies.

Parameters	Number (situation)	Percentage (%)
Age		
20-40	3 (2[a])	30.0
40-60	1	10.0
60-80	3 (1[a])	30.0
>80	3 (1[a])	30.0
Gender		
Male	7 (2[a])	70.0
Female	3 (2[a])	30.0
Disability		
Persistent vegetative status	1	10.0
Intellectual disability	2 (2[a])	20.0
Physical disability	3 (1[a])	30.0
Dementia	4 (1[a])	40.0
Level		
Profound	7 (4[a])	70.0
Severe	1	10.0
Moderate	1	10.0
Mild	1	10.0
Condition		
Removal of crown	1	10.0
Tooth extraction	2	20.0
Tooth preparation	2	20.0
Tooth fractured by mouth prop	1	10.0
Outside the dental clinic	4	40.0
Object		
Crown	2 (1[a])	20.0
Tooth	4 (1[a])	40.0
Bur	2	20.0
Bonding wire with composite resin	1 (1[a])	10.0
Gauze	1 (1[a])	10.0
Experience		
2–4 years (resident)	1	16.7
4–10 years (junior attending staff)	1	16.7
> 10 years (senior attending staff)	4	66.7

[a] The accident happened outside the dental clinic.

57,714 cases) for AIAOFB in the special needs patients undergoing dental procedures.

Circumstances of the ingestion of foreign bodies

Among the 10 confirmed cases of ingestion of the foreign bodies, four incidents (marked by #) occurred outside the dental clinic (Table 1). Case 4 involved ingestion of a piece of gauze, which was subsequently found in the stool a few days later. This event was witnessed by the patient's parents. Case 5 (Fig. 1) involved ingestion of the bonding wire with composite resin, and was confirmed by the abdominal radiography. Case 8 (Fig. 2) involved an implant-supported crown, which was discovered missing in the oral cavity during the routine oral examination, with the radiographic imaging confirming the ingestion of an implant-supported crown with a screw. Case 10 involved the ingestion of a fractured tooth fragment, which was similarly verified by radiography. Notably, all four patients involved in the extra-clinical incidents had profound disabilities.

The remaining six cases occurred within the dental clinic during the routine dental procedures. The ingested foreign bodies included swallowed teeth (extracted or fractured tooth), prostheses (porcelain fused to metal crown or implant-supported crown), and burs (high speed diamond round bur or low speed white stone bur), and they were subsequently monitored for the natural excretion one to two weeks later, as confirmed by the follow-up abdominal radiographs. In Case 7, the swallowed tooth was excreted after a delayed period exceeding two weeks.

Clinical management and outcomes

No instances of foreign body aspiration into the trachea or bronchi were identified; all foreign bodies were ingested into the gastrointestinal tract. Among the 10 confirmed cases, seven cases (70.0 %) resulted in the spontaneous excretion of the foreign bodies along with the stool and three cases (30.0 %) required the endoscopic retrieval, particularly the bonding wire with composite resin (Case 5, Fig. 1), a high-speed diamond round bur (Case 9, Fig. 3), and a low-speed white stone bur (Case 12). No cases required further surgical intervention to remove the foreign bodies.

Demographic and clinical characteristics

As summarized in Table 2, the 10 confirmed cases consisted of seven male patients (70.0 %) and three female patients (30.0 %), with an age range of 22–89 years (mean, 62.4 ± 25.0 years). The patients presented with various disabilities, including persistent vegetative state (n = 1, 10.0 %), intellectual disability (n = 2, 20.0 %), physical disability (n = 3, 30.0 %), and dementia (n = 4, 40.0 %). The majority of cases involved the patients with profound disabilities (n = 7, 70.0 %), while for severe, moderate, and mild disability levels each was noted in one case (10.0 %).

The foreign body ingestion events were associated with the following clinical situations, including the crown removal (1 case, 10.0 %), tooth extraction (2 cases, 20.0 %), tooth preparation (2 cases, 20.0 %), tooth fracture due to mouth prop use (1 case, 10.0 %), and extra-clinical ingestion events (4 cases, 40.0 %). The types of ingested objects included the crown (1 case, 10.0 %), teeth (4 cases, 40.0 %), burs (2 cases, 20.0 %), a bonding wire with composite resin (1 case, 10.0 %), and a piece of gauze (1 case, 10.0 %).

Clinician experience and risk of foreign body ingestion

The level of clinical experience among practitioners did not appear to significantly influence the occurrence of foreign body ingestion. Among the six in-clinic cases, four cases (66.7 %) occurred during the dental procedures performed by the senior attending staff (>10 years of clinical experience), one case (16.67 %) was managed by a resident (2–4

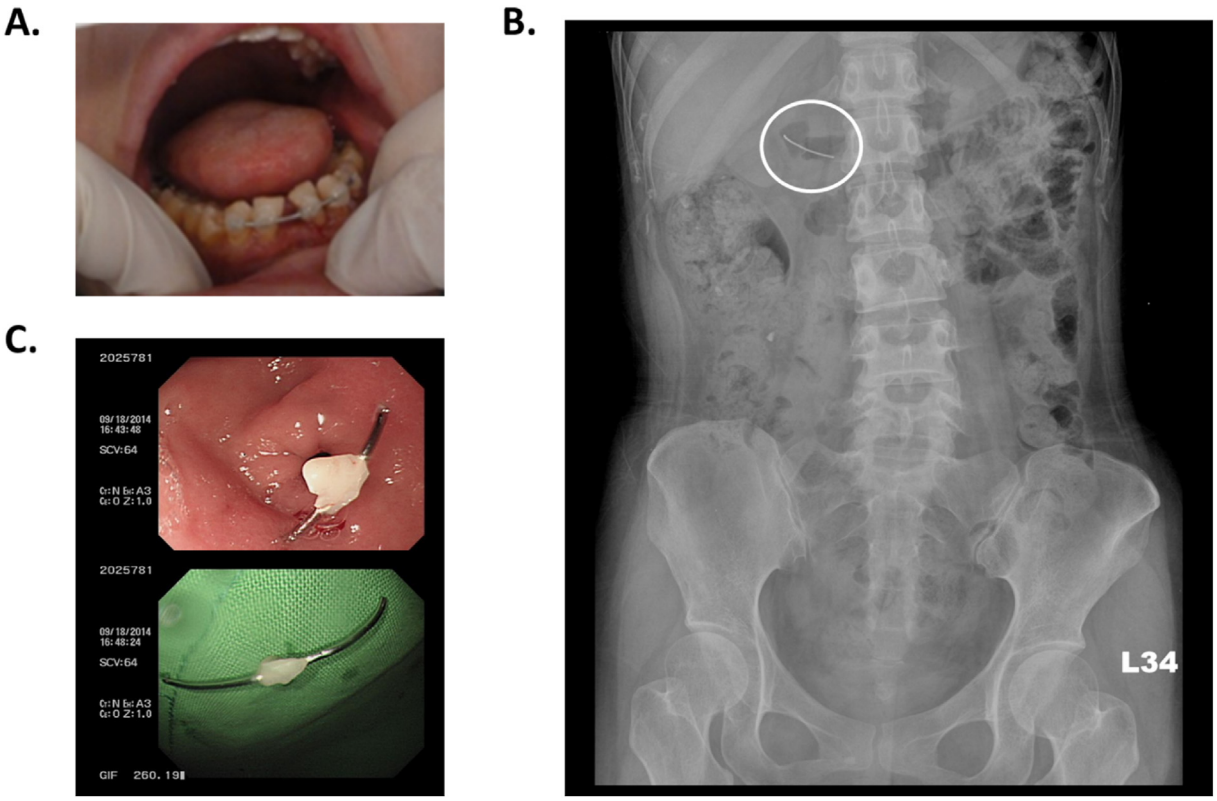

Figure 1 In Case 5, a bonding wire with composite resin was ingested and subsequently removed via the endoscopic retrieval. **A.** The traumatic teeth were stabilized using a bonding wire with composite resin. **B.** An abdominal radiograph revealed the wire located in the right upper quadrant, highlighted within a circular marker. **C.** The bonding wire with composite resin was identified in the intestine and successfully removed through the endoscopy.

years of clinical experience), and one case (16.67 %) was handled by a junior attending staff (4—10 years of clinical experience).

A statistical analysis was performed to assess the relationship between the clinicians' experiences and the patients' disability levels (Table 3). The clinicians were categorized into two groups: one with $\leq$10 years of clinical experience and the other with $>$10 years of clinical experience. The four out-of-clinic cases were excluded from this analysis because they were unrelated to the clinician performance. Among the remaining cases, the distribution of disability levels was as follows: profound disability (3 cases), and severe, moderate, and mild disabilities (1 case each). The results of the chi-square test showed no statistically significant association of the clinicians' experiences with the patients' disability levels ($P = 0.33$).

Discussion

The AIAOFB is a rare event in the general population, with the reported incidence being less than 1%—12 %.[12,13] The predisposing factors for the AIAOFB include the advanced age, intellectual disability, psychiatric conditions, a strong gag reflex, and the anxiety.[14] In our study, 60 % of the affected patients were over 60 years of age, and 70 % had the profound disabilities. The patients with special needs are considered at a higher risk for the AIAOFB, both during the dental procedures and outside the dental clinic, due to their limited cooperation and cognitive impairment. However, the prevalence of AIAOFB in our study (0.017 %) was lower than that reported in the previous studies.[12—14]

Unlike the general population, the patients with special needs may unintentionally remove the objects from their mouths, such as the fixation wires with composite resin, and subsequently swallow them (Case 5). They may also ingest fractured crowns or loosened prostheses (Cases 8 and 10). For such patients, alternative treatments, including interproximal resin splinting or ivy loop fixation, should be considered as substitutes for the wire with composite resin fixation.

To prevent the accidental ingestion or aspiration, instruments, such as files, bite blocks, and screwdrivers, placed inside the oral cavity should be secured with the dental floss to facilitate its retrieval if dropped. However, in cases where the dental floss attachment is impractical, additional preventive measures, including the use of rubber dams and superficial throat packs, should be implemented. A damp gauze covering the oropharyngeal opening, lightly touching the uvula, is recommended to minimize coughing and enhance the patient comfort.[15] This technique is applicable to both conscious and sedated patients and is particularly beneficial for those undergoing nitrous oxide sedation, as it also prevents gas leakage.

For patients with hypermobile or severely decayed teeth, caregivers should be informed of the potential risk of

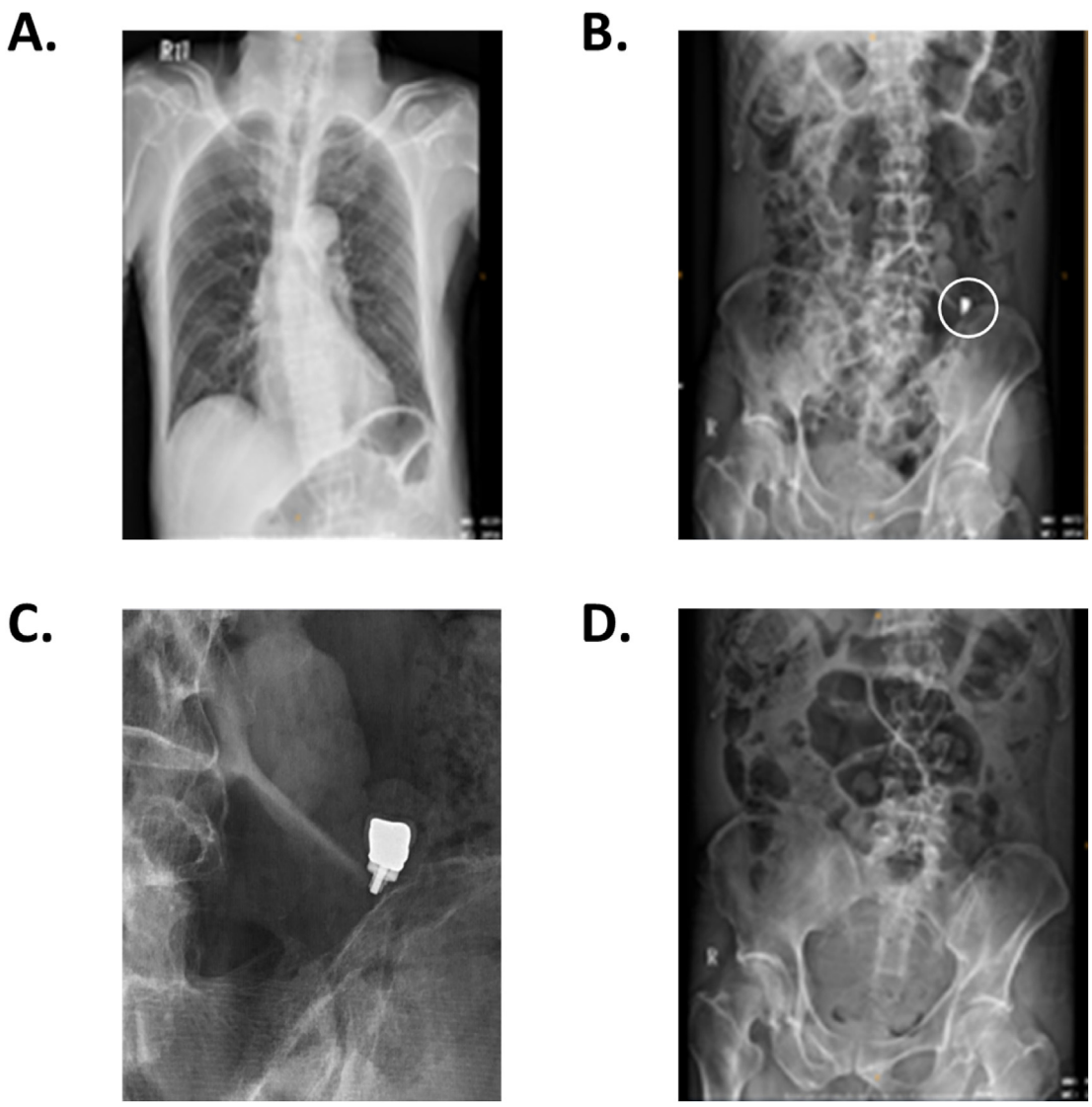

Figure 2 In Case 8, an implant-supported crown was ingested into the digestive system and discovered during the routine dental examination. **A.** The chest radiograph showed no abnormalities. **B.** The abdominal radiograph revealed a radiopaque object near the median site of the left iliac bone. **C.** A magnified view of the abdominal radiograph identified the object as an implant-supported crown with a screw. **D.** Two weeks later, a follow-up abdominal radiograph showed no evidence of the radiopaque object.

accidental ingestion or aspiration. Proper documentation of such incidents during the dental procedures is essential.[10] While the mouth props are commonly used, their placement on the hypermobile or severely decayed teeth should be avoided, as it may lead to tooth exfoliation or fracture within the oral cavity. If an object is accidently dropped into the mouth, the dental team should promptly tilt the patient's head towards the affected side and calmly attempt to remove the detached object from the oral cavity.

In cases of suspected foreign body ingestion or aspiration, immediate chest and abdominal radiographies should be performed to determine the object's location. Webb et al.[16] reported that 92.5 % of the ingested foreign bodies enter the digestive tract, while 7.5 % lodge in the tracheobronchial tree. If an object is located in the respiratory tract, urgent bronchoscopy is required for the retrieval of the foreign object. In cases involving the digestive tract, the endoscopic removal is recommended within 4 h for the sharp objects, those longer than 10 cm (6 cm in children), and those wider than 2.5 cm in diameter.[14,17] The European Society of Gastrointestinal Endoscopy strongly recommends computed tomography (CT) scanning for the patients with suspected perforation or other complications requiring the further surgical intervention.[18] In Case 9, an ingested bur remained in the same location for one week, raising the suspicion of digestive tract perforation. A CT scan was performed to confirm its position and facilitate removal via panendoscopy. If an object is smooth, small, and asymptomatic (excluding batteries or magnets), conservative management with observation is advised, as most of them pass through the

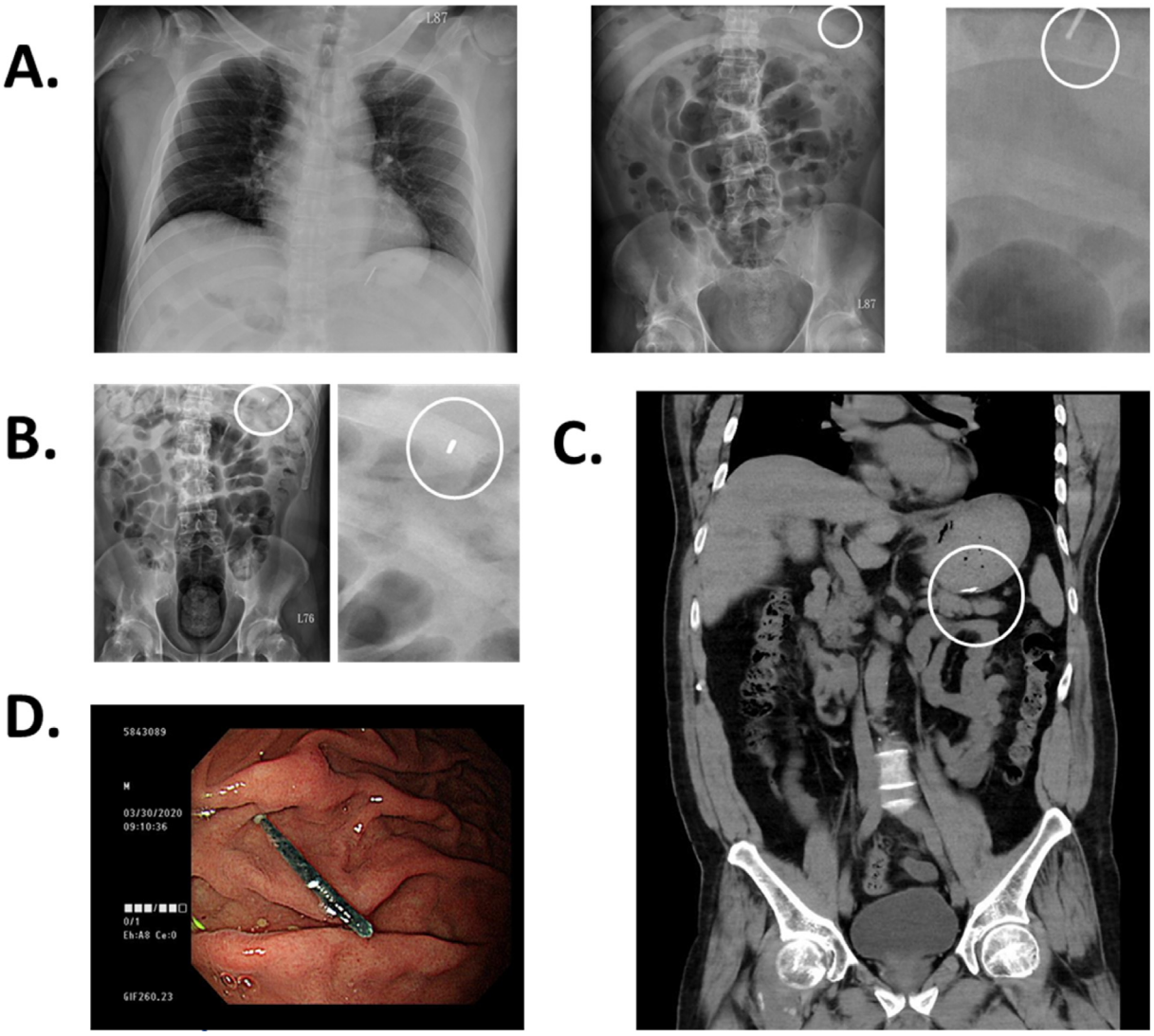

Figure 3 In Case 9, a high-speed diamond round bur was accidently ingested during a dental procedure. **A.** The chest and abdominal radiographs taken on the same day revealed the bur in the stomach area. **B.** One week later, the follow-up radiograph showed the bur remained in a similar position without the significant movement. **C.** Computed tomography confirmed the location of the bur in the lower portion of the stomach body. **D.** During the panendoscopy examination, the bur was found resting on the stomach mucosa and was successfully removed 12 days after the accidental ingestion.

gastrointestinal tract without causing complications within one week.[18] However, in bedridden patients with the reduced gastrointestinal motility, excretion may take a longer time, as seen in Case 7, where the ingested tooth was expelled more than two weeks later.

Several studies have reported higher rates of accidental foreign body ingestion among predoctoral students or inexperienced practitioners.[12,19,20] However, in our study, the risk of ingestion of foreign body appeared independent of the clinicians' experiences. This may be attributed to the unique challenges of treating the special needs patients who are prone to sudden movements or agitation during the dental procedures. These unpredictable behaviors increase the likelihood of ingestion or aspiration of the foreign bodies, even under the care of the very experienced clinicians. Additionally, as the senior dentists constitute the majority of practitioners in our Oral Health Care Center for Special Needs, they are responsible for treating most patients with special needs, leading to a higher number of reported cases of accidental ingestion of foreign bodies within this group.

This study highlights that accidental ingestion of foreign bodies during the dental procedures in the patients with special needs remains a potential risk, regardless of the clinicians' experiences. Therefore, strict preventive

Table 3 The relationship between the clinicians' experiences and the patients' disability levels.

Experience\Level	Profound	Severe	Moderate	Mild
≤10 years	1	0	0	1
>10 years	3	1	0	0

measures and heightened vigilance are essential. The dentists must be well-equipped to promptly recognize and manage the emergencies involving the ingestion or aspiration of dental instruments or materials to ensure the patients' safety.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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None.

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