Swallowed Dentures

An Analysis of Denture Impaction Events in Pennsylvania

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Abstract

Tooth loss is a prevalent health concern affecting two-thirds of the geriatric population in the United States. Most patients experience missing teeth with dentures, which have the potential to become dislodged, swallowed, and stuck somewhere along the gastrointestinal tract (termed denture impaction). We queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) and identified 68 denture impaction events reported from 2004 to 2019. An in-depth analysis revealed that patients were most often male, and the median patient age was 77 years. The most common symptoms reported by patients with denture impaction included difficult and/or painful swallowing, breathing trouble or respiratory distress, sore throat, foreign body sensation in the throat, throat obstruction preventing insertion of a tube or scope, choking, excessively thick and/or bloody oral secretions, and vomiting or regurgitation of food. The pharynx was the most common site of denture impaction, and x-ray imaging was the most common diagnostic test mentioned. The most common method of removal was surgery, and the most common surgical procedures employed were esophagogastroduodenoscopy and laryngoscopy. We believe we have identified a category of denture impaction events that has not previously been characterized. Our study, coupled with the existing medical literature, suggests that all patients, along with their caregivers and healthcare providers, should be aware of the proactive steps to avoid denture impaction, as well as signs and symptoms which require early identification and treatment.

Keywords: choking, denture, denture impaction, edentulism, intubation, swallowed dentures, delayed diagnosis

Introduction

Tooth loss is a prevalent health concern affecting two-thirds of the geriatric population in the United States and worldwide. At least 10% of individuals in the United States have no teeth (termed complete edentulism), and more than one-third are missing at least one tooth (termed partial edentulism). Within the geriatric population in the United States, two-thirds of individuals are either partially or completely edentulous.1 Individuals with edentulism often desire to replace missing teeth to improve the outward appearance of their smile and to prevent or reduce problems associated with oral health and hygiene. They may have identified a category of denture impaction events that has not previously been characterized. Our study, coupled with the existing medical literature, suggests that all patients, along with their caregivers and healthcare providers, should be aware of the proactive steps to avoid denture impaction, as well as signs and symptoms which require early identification and treatment.

Keywords: choking, denture, denture impaction, edentulism, intubation, swallowed dentures, delayed diagnosis

IN THE UNITED STATES

At least 10% of individuals have no teeth.

More than 1/3 are missing at least one tooth.

WITHIN THE GERIATRIC POPULATION IN THE UNITED STATES

2/3 of individuals are either missing at least one tooth or have no teeth.

90% of individuals with tooth loss have some type of denture.

Whether permanent or removable, dentures have the potential to become dislodged from the usual site; the patient may then inadvertently swallow the denture once it is loose in the mouth. Depending on the size and shape of a denture as well as the circumstances surrounding a denture-swallowing event, a denture may then be lodged somewhere along the gastrointestinal (GI) tract (termed denture impaction). After reading about a denture impaction event involving a man in England who swallowed his dentures while under anesthetics for a surgical procedure, we queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) to identify and analyze denture impaction events that have occurred in Pennsylvania.2 Although the patient safety event reports reviewed are only from acute care facilities, we believe the insights from our analysis will be universally beneficial to healthcare providers in all practice settings—including primary care providers and dentists—as well as to patients who wear dentures or their caretakers.

Methods

We queried PA-PSRS for events that occurred between May 1, 2004, and October 31, 2019. We searched the event detail for events containing a combination of one of the following keywords: “denture,” “partial plate,” “false teeth,” “bridge,” “artificial teeth,” or “dental implant,” AND one of the following keywords: “swallow,” “choke,” “lodged,” “stuck,” “impact,” “throat,” “esophag,” or “pharynx.” We independently reviewed and coded each report and resolved any discrepancies through joint analysis and consensus. We conducted a preliminary review of each report to identify events for inclusion and performed an in-depth analysis. An event was included in the analysis if it involved a patient who experienced the dislodgement of any number of artificial teeth from the usual site; artificial teeth could include dentures, partial plates, bridges, or implants. All other events were excluded. We then reviewed each event that met the inclusion criteria and classified it as either a near miss or a denture impaction. A near miss event was defined as an event in which the artificial tooth or teeth were dislodged but immediately removed from the mouth upon identification and before causing an obstruction. A denture impaction event was defined as an event in which the artificial tooth or teeth were dislodged but not immediately identified, and subsequently were found somewhere along the GI tract. We performed a descriptive analysis of denture impaction events to identify trends in patient age and gender, as well as event classification and harm score. We then performed an in-depth qualitative analysis of denture impaction events, coding each report for the following type of dental appliance involved, diagnostic studies performed to locate the denture, the anatomic site along the GI tract where the denture was lodged, whether the denture impaction occurred prior to or during the present admission, the activity that contributed to the denture dislodgement and subsequent impaction, the patient’s physical location when the activity that contributed to the denture dislodgement occurred, and whether there was a delay in diagnosing the denture impaction. We performed a brief qualitative analysis of near miss events, coding each event according to the type of dental appliance involved and the activity that contributed to the near miss.

Results

The query returned 229 event reports; two separate event reports described a single event, so the total number of events was 228. We classified 68 events as denture impaction events and 86 events as near misses. The remaining 74 event reports were determined to be unrelated to denture impaction and were excluded from the analysis; many of the events that were excluded described injuries to the bridge of the nose.

In-Depth Analysis of Denture Impaction Events

Descriptive Analysis

Patients who experienced a denture impaction were more often male (75%; 51 of 68) than female (25%; 17 of 68). Patients ranged in age from 20 to 94 years old. The median patient age was 77 years (inter-quartile range = 65 to 83 years).

A total of 51 events (75%) were classified by the reporting facility as incidents.2 An incidence was defined as an event, occurrence, or situation involving the clinical care of a patient in a medical facility which could have injured the patient but did not either cause an unanticipated injury or require the delivery of additional healthcare services to the patient.2 A serious event is defined as an event, occurrence, or situation involving the clinical care of a patient in a medical facility that results in death or compromises patient safety and results in an unanticipated injury requiring the delivery of additional healthcare services to the patient.

Qualitative Analysis

We reviewed free text fields in each PA-PSRS report, including Event Detail, Event Recommendation, and Event Comments, to gather additional information about each event. The dental appliance involved in each denture impaction event was either a denture (81%; 55 of 68) or a bridge (19%; 13 of 68). Some events involving a denture further specified that the appliance was a partial denture (22% [12 of 55]) or a full plate (26% [14 of 55]). More than one-third (38%; 26 of 68) of the events indicated that one or more diagnostic tests were performed to locate the impacted denture. X-ray imaging was the most common diagnostic test (n=22), followed by swallowing studies (n=3), CT scans (n=1), and MRIs (n=1). Dentures were found at multiple points along the GI tract, from the mouth to the stomach. The anatomical site of denture impaction was specified in 75% (51 of 68) of events. The terminology used in events to describe the site of denture impaction included epiglottis, esophagus, pharynx, mouth, oropharynx, pharynx, stomach, and throat. We grouped events involving impaction of four anatomic areas in the upper GI tract: mouth, pharynx (which included events that specified the site of impaction as both mouth and oropharynx), hypopharynx, esophagus, and throat (see Figure 1). The pharynx was

PA-PSRS is a secure, web-based system through which Pennsylvania hospitals, ambulatory surgical facilities, abortion facilities, and birthing centers submit reports of patient safety–related incidents and serious events in accordance with mandatory reporting laws outlined in the Medical Care Availability and Reduction of Error (MCARE) Act (Act 13 of 2002). All reports submitted through PA-PSRS are confidential and no information about individual facilities or providers is made public.
the most common site of denture impaction, mentioned in 35 events. Sufficient information was provided in 87% (59 of 68) of events to determine when the denture impaction likely occurred. We determined that 25% (15 of 59) of events occurred prior to the present admission, while 75% (44 of 59) of events occurred during the present admission. Among events that occurred prior to admission, the most common locations were a nursing home or skilled nursing facility (40%; 6 of 15) and at the site of a prehospital emergency (38%; 5 of 15). Among events that occurred during the present admission, the most common locations were in an operating room (41%; 18 of 44) or a nursing unit (36%; 16 of 44).

The activity that likely contributed to the denture impaction was identified in 62% (42 of 68) of events. The most common activities were intubation (62%; 26 of 42), eating (14%; 6 of 42), a motor vehicle accident (5%; 2 of 42), and application of a BiPAP mask (5%; 2 of 42) (see Figure 2). Other activities that likely contributed to the denture impaction included sleeping, seizure activity, and oral suctioning.

Details about signs and symptoms of denture impaction were described in 35 events. The most common symptoms included: difficult and/or painful swallowing (23%; 8 of 35), breathing trouble or respiratory distress (20%; 7 of 35), sore throat (17%; 6 of 35), foreign body sensation in the throat (14%; 5 of 35), throat obstruction preventing insertion of a tube or scope (14%; 5 of 35), choking (14%; 5 of 35), excessively thick and/or bloody oral secretions (11%; 4 of 35), and vomiting or regurgitation of food (6%; 2 of 35). In one-quarter (17 of 68) of events, the patient or their family noted that the artificial tooth or teeth were missing; in 7 of these events, the patient was asymptomatic. We identified clear evidence of a delayed diagnosis of denture impaction in 15% (10 of 68) of the events.

Information about the method of removal for the impacted denture was included in 59% (40 of 68) of events. The impacted denture was manually removed in 20% (8 of 40) of events, in some cases with the assistance of a tool or medication, such as forceps (n=3) or midazolam (n=2). The impacted denture required surgical removal in 58% (23 of 40) of events. The most common surgical procedures employed were esophagogastroduodenoscopy (EGD; 43%; 10 of 23) and laryngoscopy (26%; 6 of 23). The reporting facility had to transfer the patient to an outside hospital for treatment in 8% (3 of 40) of events. A health-care provider or team removed the impacted denture in 69% (47 of 68) of events; specific providers mentioned in events included the treating physician or team (17%; 8 of 47), a specialist physician or team (17%; 8 of 47), and a nurse or allied health provider (11%; 5 of 47). Intervention was not necessary in 6 events for the following reasons: the loose denture fell out of the patient’s mouth (n=1); the patient expectorated (n=1) or vomited (n=1) the impacted denture; or the patient swallowed the denture and it reached the stomach (n=3). The patient or a family member removed the denture in 3 events.

Brief Analysis of Near Miss Events

The most common dental appliance involved in near miss events was a bridge (47%; 40 of 86), a single artificial tooth (34%; 29 of 86), or a denture (20%; 17 of 86). Patients who experienced a near miss were more often female (59%; 51 of 86) than male (41%; 35 of 86). Patients ranged in age from 16 to 91 years old. The median patient age was 64 years (interquartile range = 53 to 74). Intubation and/or surgery were identified as a contributing factor in 92% (79 of 86) of near miss events. Other activities that contributed to near miss events included eating, sleeping, and swallowing medication.

Discussion

To our knowledge, our study is the first of its kind to analyze patient safety events related to denture impaction reported by acute care facilities. It also included more denture impaction events than any other analysis published in the last decade and therefore adds considerable information to the current body of knowledge on the subject. To compare our findings with the existing literature, we analyzed 35 individual case reports and three case series (describing a total of nine patients) published during a 10-year period from January 1, 2010, through December 31, 2019.31-46 We also analyzed six retrospective reviews of denture impaction in the esophagus published during the same time period.47-52 These case reports, case series, and retrospective reviews were reported by providers from 20 different countries across six continents.47-50

Gender and Age Distribution

In our study of denture impaction events, three-quarters of patients were male (see Figure 3). We observed a similar trend in the medical literature. Patient gender was specified in all but one case report and in all case series, and about 8 out of every 10 patients were male.5, 16-18 Patient gender was specified for patients in all but one of the retrospective reviews that were analyzed; nearly 7 out of 10 patients in these reviews were male.47-52 While it seems clear that men are more likely to experience a denture impaction event, the reason for this is unclear. Interestingly, women are more likely than men to experience tooth loss (although this difference is becoming less pronounced in North America), and women are more likely than men to have partial dentures.47-49

The median patient age in our study was 77 years, which was older than the median age of patients that we observed in the medical literature. Age was specified for nearly all patients in the case reports and case series we analyzed, in which patients ranged in age from 31 to 85 years old.53-55 Half of the retrospective reviews we analyzed were from Nigeria, and the median age of patients in those reviews ranged from 50 to 57 years, which was lower than both the median patient age in our study and in the case reports and case series we reviewed.47-50, 52

The differences we observed in median age may be reflective of the accessibility of dental care services around the world. According to the World Health Organization (WHO), dental care services in developing countries are typically focused on pain relief and emergency services rather than on preventive services.56 The differences in care may in part be attributable to the scarcity of dental providers; for example, the dentist to population ratio in industrialized countries is 1 dentist per 2000 individuals, compared to 1 dentist per 150,000 individuals in African countries.57 Another factor that may have influenced the observed difference in median age is the difference in life expectancy. According to recent data, life expectancy in the United States is 79 years, while the life expectancy in Nigeria is 62 years.58

Activity Leading to Denture Impaction

In the subset of denture impaction and near miss events for which the activity that likely contributed was
identified, more than two-thirds of denture impaction events and almost all of the near misses were iatrogenic. In contrast, nearly all the denture impaction events reported in the medical literature were the result of an accident or a swallowing event. As a result, we attribute this difference to the unique nature of our events, which are events that happen within acute care facilities. We believe that we have identified a category of denture impaction events that has not previously been characterized in the medical literature. Healthcare providers should be aware that denture impaction is a possible complication of treatment, especially among patients who undergo intubation. In some events in our study, the patient did not alert the healthcare provider about the presence of a denture prior to a procedure. Acute care facilities may be able to prevent denture impaction events by developing more effective screening practices to identify dentures prior to surgical procedures. Some patients may not understand that the term denture can refer to any kind of removable partial or temporary dental prosthesis. It is important to ensure that the patient understands the terminology used when they are being asked about the presence of a denture prior to a procedure. Future research related to iatrogenic denture impaction in acute care facilities could further expand the knowledge base and lead to improved screening tools.

**Signs and Symptoms of Denture Impaction**

More than one-third of denture impaction events in our study did not include any information about signs or symptoms, indicating that either the patient was asymptomatic or that the information was simply not recorded, reported, or observed. The most common signs and symptoms reported by patients in both our study and across the literature who experienced denture impaction in the pharynx or the esophagus included difficult or painful swallowing, difficulty breathing or respiratory distress, foreign body sensation in the throat, voice changes, choking, sore throat, and chest pain.22-24 Although none of the patients in our study experienced denture impaction in the small intestine, large intestine, or colon, we did observe several cases with lower GI tract involvement in the case reports and case series we reviewed. Among those patients with denture impaction in the lower GI tract who were symptomatic, patients most often reported abdominal pain and altered bowel habits.25-28 The most common symptoms of denture impaction regardless of anatomic site of impaction are presented in Figure 4.

**Type of Dental Appliance**

Although most of the denture impaction events in our study involved a denture, some events did involve a bridge. In addition, nearly half of the near misses we identified in our study also involved a bridge. In our review of the medical literature, we found that all events involved a denture.18-20 Based on these findings, we speculate that dentures, especially partial dentures that are irregularly shaped or have sharp edges and metal clasps, may be more likely to become impacted along the GI tract, especially in the esophagus. In addition, identifying reports in the medical literature that involved a bridge may be challenging because the term bridge is used in other contexts (e.g., bridge of the nose or bridge in therapy).

**Diagnostic Studies**

The most common diagnostic studies identified in our analysis and in the medical literature were x-rays (especially of the chest and abdomen) and CT scans.11-13 While partial dentures with metal clasps may be more readily apparent on x-ray, the radiolucent nature of some dentures and bridges may prevent visualization on x-ray. Some clinicians suggested that CT scans may be more sensitive at detecting an impacted denture when an x-ray fails.29-31 We think that diagnostic imaging is an effective tool for identifying denture impaction in most (but not all) cases. In some cases in the medical literature, an abnormality was visualized on imaging, but the abnormality was not identified as a denture. While we are mindful of the need to avoid overtesting, additional alternative studies may be required to identify a denture in impacted denture. In cases in which all types of imaging have failed but denture impaction is suspected, a scoping procedure—such as an EGD or colonoscopy—may be necessary.

**Delayed Diagnosis of Denture Impaction**

We identified clear evidence of a delayed diagnosis of denture impaction in 15% of the events in our study, but the number is higher in the medical literature.11-13 The most common site of denture impaction was the esophagus. But a closer look at the case reports and case series that we reviewed reveals that identifying the site of impaction in the esophagus was also the site of denture impaction in most cases. We speculate that dentures, especially partial plates that are irregularly shaped or have sharp edges and metal clasps, may be more likely to become impacted along the GI tract. In cases in which all types of imaging have failed but denture impaction is suspected, a scoping procedure—such as an EGD or colonoscopy—may be necessary.

**Anatomic Site of Denture Impaction**

In our study, the most common anatomic site of denture impaction was the pharynx, and the second most common site was the esophagus. In contrast, the most common anatomic site of denture impaction identified in the case reports and case series that we reviewed was the esophagus. In the retrospective reviews we analyzed, the esophagus was also the site of denture impaction for all events included in the medical literature. As mentioned previously, none of the events in our study involved denture impaction beyond the stomach, while numerous events in the case reports and case series that we reviewed involved denture impaction in the lower GI tract.11-13,15,21,22,29,31-33

The method of data collection may have influenced the events that were identified in our study and in the medical literature. In our study, we searched for key words and terms related to denture impaction, a note in the patient’s chart that indicated an x-ray was performed, but the order was never entered. Another event described a retrospective review of multiple x-rays that showed a shadow that was not identified as a denture in the patient’s chart. In this case, the patient’s condition was not improved by any treatment, and the finding was not noted in any of the radiology reports. The diagnosis of denture impaction was also delayed in some of the case reports and case series that we reviewed. Several patients were unaware that they had swallowed a denture, so the healthcare provider lacked that information when attempting to identify the etiology of the patient’s symptoms.11-13 Notably, the patient’s symptoms in two cases were initially attributed to a suspected malignancy in the sigmoid colon, but surgical resection led to the identification of an impacted partial plate in both cases.12,13

And we included the keywords “pharynx” and “throat.” Among the case reports and case series we analyzed, the events were reported because the authors felt the event was unusual or complicated.11-13 In the retrospective reviews that we analyzed, study authors relied on certain diagnosis codes within their health system to identify denture impaction events, resulting in identification of a specific subset of events.11-13 We would hesitate to suggest that a denture is more likely to become impacted at any particular anatomic site; rather, we observed that denture impaction was more likely to become impacted along the GI tract, and thus more likely to be reported in the medical literature.

**Method of Removal**

Among events in our study that specified the method of removal for the impacted denture, surgical intervention was necessary in more than half of the events. Scoping procedures (e.g., EGD, esophagoscopy, or laryngoscopy) were the most common surgical intervention in our study and across the medical literature.11-13 More complicated cases in the medi-
In this space may provide additional procedural steps to avoid denture impaction, as symptoms of identification to avoid denture well as signs and impaction for early and treatment.

Notes

This analysis was examined from review by the Advarra Institutional Review Board.

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