Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 09 Oct 2025
Revised 14 Nov 2025
Accepted 22 Dec 2025

Natural Resources for Human Health 2025, Vol. 5 (4): 934–943

KEYWORDS:
aspiration, foreign body ingestion, dental team; rubber dam isolation, instrument ligation, throat pack, high-volume suction, four-handed dentistry.

The Effectiveness of Dental Team Strategies in Preventing Aspiration and Swallowing of Foreign Objects During Dental Procedures

Abdulaziz Mohammed Mohammed Alshehri[1], Refah Abdullah Alsubaie[2], Khaled Soliman Hamed Alahmadi[3], Alanoud Abdulaziz Hassan Binsufayan[4], Mohammed Marai Saleh AlQarni[5], Ohoud Hamoud Alshammari[6], Asiri, Saud Ahmed M[7], Sama Abdullah Mohammed Alotaibi[8], Athar Ali Bin Mousa Asiri[9], Hajar Inad Alenezi[10]

[1] Endodontic Consultant – Dental Center in Khamis Mushait – Asir Health Cluster – Ministry of Health – Khamis Mushait – Asir Region – Saudi Arabia
Email: aalshehri231@moh.gov.sa
[2] Dentist – Erqah Primary Health Care Center – Riyadh Health Cluster – Ministry of Health – Riyadh – Riyadh Region – Saudi Arabia
Email: Reaalsubaie@moh.gov.sa
[3] General Dentist – Ministry of Health – Madinah – Madinah Region – Saudi Arabia
Email: khsoalahmadi@moh.gov.sa
[4] General Dentist – Third Riyadh Health Cluster – Ministry of Health – Riyadh – Riyadh Region – Saudi Arabia
Email: Abinsufayan@moh.gov.sa
[5] Dentist – Al-Farsha General Hospital – Asir Health Cluster – Ministry of Health – Al-Farsha – Asir Region – Saudi Arabia
Email: momaalqarni@moh.gov.sa
[6] General Dentist – Al Malqa Primary Health Care Center – Third Riyadh Health Cluster – Ministry of Health – Riyadh – Riyadh Region – Saudi Arabia
Email: ohhalshammmari@moh.gov.sa
[7] Dental Assistant – Bariq Health Sector – Asir Health Cluster – Ministry of Health – Bariq – Asir Region – Saudi Arabia
Email: sasirri@moh.gov.sa
[8] General Dentist – Al Malqa Primary Health Care Center – Third Riyadh Health Cluster – Ministry of Health – Riyadh – Riyadh Region – Saudi Arabia
Email: samaalotaibi@hotmail.com
[9] Dental Assistant Technician – Al Muhammadiyah 1 Primary Health Care Center – Third Riyadh Health Cluster – Ministry of Health – Riyadh – Riyadh Region – Saudi Arabia
Email: 4th4rr@gmail.com
[10] Dental Assistant – Northern Borders Health Cluster – Ministry of Health – Arar – Northern Borders Region – Saudi Arabia
Email: HaiAlenezi@moh.gov.sa

ABSTRACT: Aspiration and swallowing of foreign objects during dental treatment — crowns, endodontic files, implant components, impression material, rubber dam clamps, and small instruments — represent a low-frequency but high-consequence adverse event.

Natural Resources for Human Health
eISSN: 2583-1194

The clinical literature consistently frames prevention not as the responsibility of the operator alone, but as a function of the entire dental team operating within a coordinated system. The most effective strategies converge on a small number of well-evidenced principles: routine use of rubber dam isolation, especially for endodontic and restorative procedures in posterior teeth; ligation or floss-tethering of small instruments such as files, clamps, and implant drivers; high-volume aspiration positioned by a trained assistant who anticipates the operator's movements; and the use of gauze throat packs or a floss-augmented isolation field where isolation alone is insufficient. Crucially, these measures work best as a bundle rather than as isolated precautions, and their reliability depends on explicit role assignment — who places the dam, who secures the ligature, who maintains suction, and who monitors the patient's airway — so that no step is assumed to be someone else's.The evidence base for these strategies is largely derived from case reports, retrospective reviews, and consensus guidance rather than randomized trials, which is unsurprising given the rarity of events and the ethical difficulty of studying them prospectively. What the available data suggest is that events cluster around predictable circumstances: unisolated posterior teeth, unligated small instruments, single-handed operator-assistant arrangements, supine patients with reduced protective reflexes, and procedures performed without a throat pack or adequate suction. This pattern supports the inference that team-based, protocol-driven prevention is effective — but it also indicates that effectiveness is contingent on adherence, which in turn depends on structured training, team drills, pre-procedural risk assessment, and a shared understanding of the retrieval plan should an object be lost. Failure to recover an object promptly, or a patient who cannot confirm the object was retrieved, warrants chest and abdominal radiography and referral, and the team's preparedness for this escalation is properly part of the preventive strategy itself rather than an afterthought.

INTRODUCTION:

Aspiration and ingestion of foreign objects during dental treatment are low-incidence but disproportionately consequential patient-safety events. The largest published review of accidental aspiration and ingestion during dental procedures examined 617 cases and confirmed that although many objects pass through the gastrointestinal tract without long-term harm, aspirated items can produce airway obstruction, lung abscess, pneumonia, pneumothorax, or fatal asphyxiation [1]. The very small size of endodontic files, implant drivers, crown fragments, and extracted teeth, combined with the supine or semi-supine position of the patient and the presence of saliva, creates a microenvironment in which a momentary loss of control can convert a routine appointment into a medical emergency [2]. What makes this complication particularly important for the dental team is that it is, in the overwhelming majority of reported cases, preventable; prevention rather than retrieval is the definitive standard, and prevention is a team function rather than the responsibility of the operator alone [3].

The concept of the dental team in this context extends beyond the dentist to include the chairside assistant, the dental hygienist, the reception and administrative staff who schedule and prepare patients, and the wider clinical governance structure that determines protocols, training, and equipment maintenance. The effectiveness of prevention therefore cannot be evaluated solely by the technical performance of a rubber dam or a suction tip; it must be assessed by the degree to which the team coordinates barrier isolation, high-volume evacuation, instrument security, patient positioning, risk stratification, and emergency readiness as an integrated system [3].

Epidemiology and the Clinical Burden of Aspiration and Ingestion

The epidemiological picture of dental foreign-body events is shaped by underreporting, heterogeneity in case definitions, and the distinction between aspiration and ingestion. The 617-case review found that aspiration and ingestion occur across all age groups, with aspiration more frequently reported in older patients and ingestion more frequently reported in younger patients [1]. A seven-year retrospective study of a university dental hospital identified two aspiration cases and thirty-seven ingestion cases, but the incidence rate rose steadily with age and increased sharply among patients aged eighty years or older [2]. Male patients were overrepresented in that series, with a male-to-female incidence ratio of 2.8:1, and the departments of

prosthodontics and the predoctoral student clinic recorded the highest rates, a finding that points toward the combined influence of complex prosthodontic components and operator experience [2].

The clinical significance of these figures lies less in the absolute numbers than in the pattern of risk. Aspirated objects tend to lodge in the right bronchus or lung because the right main bronchus has a wider diameter and a less acute angle from the trachea than the left [4]. This anatomical predisposition means that even a small object that passes the larynx can produce a persistent, often silent, pulmonary foreign body. The case of a seventy-six-year-old patient who aspirated a dental drill head during a procedure and presented to the emergency department without typical symptoms illustrates the diagnostic hazard: imaging revealed a foreign body in the right airways despite the absence of cough, dyspnea, or stridor [4]. The absence of symptoms does not equate to the absence of aspiration, and the dental team must therefore treat any unaccounted-for small object as a potential airway event until proven otherwise. The same principle applies to ingestion, where more than ninety percent of patients in the 617-case review were asymptomatic, reinforcing the need for systematic object accounting rather than reliance on clinical signs alone [1].

Risk Stratification: Patient, Procedure, and Operator Factors

Effective prevention begins with the recognition that risk is not uniformly distributed. The dental team must stratify every patient according to three intersecting domains: patient-related vulnerability, procedure-related hazard, and operator- and team-related factors [5]. Patient-related risk is concentrated in the very young and the very old, in patients with neurocognitive deficits, psychiatric illness, alcohol dependence, intellectual disability, neuromuscular disease, or a diminished gag and cough reflex, and in patients whose ability to protect their own airway is compromised by sedation or general anesthesia [5]. The seven-year retrospective study found that seven of thirty-seven patients with accidental ingestion had intellectual disability, Lou Gehrig's disease, dystonia, or oral and maxillofacial cancer, and the authors concluded that practitioners must actively identify high-risk patients rather than assume that routine precautions are sufficient [2]. Pediatric patients under three years of age carry a particularly high risk of aspiration, and elderly patients with polypharmacy, xerostomia, or a history of dysphagia require explicit preoperative airway assessment [6].

Procedure-related risk is highest during manipulations involving small, smooth, or loose components: endodontic instrumentation, implant placement and prosthetic screwdriving, crown and bridge cementation, extraction of fractured or root-treated teeth, and orthodontic bracket or band removal [1]. The 617-case review found that cases were more frequent in fine, cumbersome, and time-consuming procedures, and that any foreign object could be aspirated or ingested regardless of its shape, size, or length [1]. Operator- and team-related risk includes inexperience, fatigue, inadequate lighting, ineffective assistance, poor suction technique, and failure to use a rubber dam when indicated [7]. The same review identified closing the mouth and moving the head, discomfort and uncooperative behavior, gagging, instrument fatigue, and failure to tie floss as proximate causes in the small number of case reports that documented causation, each of which is a modifiable team-process variable rather than an immutable patient characteristic [1]. The endodontic safety literature further emphasizes that small instruments can separate or be dropped even in experienced hands, which is why the team must build redundancy into every high-risk step rather than rely on operator vigilance alone [8].

Table 1. Risk Stratification Framework for Dental Foreign-Body Aspiration and Ingestion

Domain	High-risk categories	Team implication
Patient	Children under three; adults over eighty; neurocognitive impairment; psychiatric illness; alcohol dependence; diminished gag or cough reflex; sedation or general anesthesia; denture wearers with reduced palatal sensitivity	Preoperative screening; modified positioning; additional barriers; consider alternative treatment setting [2][5]
Procedure	Endodontics; implant surgery; fixed prosthodontics; extractions of root-treated or fractured teeth; orthodontic debonding; any procedure with small, loose components	Rubber dam; floss ligature; throat pack; continuous high-volume suction; pre- and post-operative object counts [1][8]
Operator and team	Inexperience; fatigue; inadequate lighting; ineffective four-handed assistance; poor suction technique; failure to use rubber dam	Supervision of junior operators; structured briefing; assistant-led suction and retraction; equipment checks [7]

The Rubber Dam as the Foundational Barrier Strategy

The rubber dam is the single most extensively documented mechanical barrier against aspiration and ingestion during restorative and endodontic treatment. Its use is described in the endodontic literature as the minimum safety standard of care, not merely as an isolation convenience, because it physically excludes instruments, irrigants, and tooth fragments from the oral cavity and pharynx [8]. The American Academy of Pediatric Dentistry and multiple case reports identify rubber dam application during all restorative and endodontic procedures as a core aspiration-prevention measure, and evidence-based guidance recommends rubber dam use at all times during root canal procedures specifically to reduce ingestion and aspiration risk [6][7]. The rubber dam also retracts hard and soft tissues and improves visibility, but its protective function is independent of these ergonomic benefits and should be articulated to patients as a safety intervention rather than an optional comfort measure [7].

The effectiveness of the rubber dam is, however, conditional on correct application and on the team's willingness to use it in situations where access or patient cooperation is challenging. A case report of a child treated under conscious sedation described aspiration of an endodontic instrument after the procedure was carried out without isolation because the patient exhibited slight discomfort with rubber dam placement [9]. This case is instructive because it demonstrates that the barrier is effective only when the team treats its omission as a deviation requiring documented justification and compensatory measures, not as a routine accommodation [9]. When rubber dam placement is genuinely impossible—for example, in some patients with severe gag reflex, altered mental status, or limited mouth opening—the team must substitute a combination of gauze throat barriers, floss ligatures, and continuous suction, and must document the rationale for the alternative strategy [6].

A further and often underappreciated point is that the rubber dam protects against objects that originate outside the operative field. Rubber dam clamps themselves can fracture or become dislodged, and the literature recommends securing clamps with floss ligatures as an adjunct to the dam [6]. The dam therefore functions as part of a layered system rather than as a standalone guarantee, and the team's check of clamp security before starting treatment is as important as the decision to place the dam [7]. In this sense, the rubber dam is not merely a device but a team habit: the assistant prepares the clamp and floss, the operator verifies stability, and the team confirms that the isolation plan matches the patient's risk profile before treatment proceeds [8].

High-Volume Evacuation and Four-Handed Suction Technique

High-volume evacuation is the second pillar of aspiration prevention and is intimately dependent on team coordination. Four-handed dentistry allows the assistant to maintain continuous suction while the operator's hands are occupied with the handpiece, mirror, and retraction, and the evidence on four-handed technique shows that assistant-held high-volume suction substantially improves the positioning and efficiency of evacuation compared with operator-held or intermittent suction [10]. The American Dental Association recommends high-volume evacuation capable of removing up to 100 cubic feet of air per minute to capture droplets and particulate debris at the site of generation, and this recommendation is most reliably implemented when a dedicated assistant is responsible for evacuation throughout the procedure [11]. The chairside assistant's role in moisture control is therefore not merely supportive; it is a primary preventive function, because the assistant can maintain continuous suction while the operator concentrates on the operative field [12].

The effectiveness of suction is determined by tip placement, suction strength, and continuity. A high-volume evacuator held at the margin of the operative field removes debris before it can migrate posteriorly, whereas a saliva ejector placed passively in the floor of the mouth does not generate sufficient negative pressure to capture a dislodged crown or an endodontic file [10]. The team should therefore distinguish explicitly between saliva control and safety evacuation, and the assistant should be trained to reposition the high-volume tip dynamically as the operator moves between quadrants [11]. In procedures performed under sedation or general anesthesia, where the protective reflexes are depressed, continuous high-volume suction becomes even more critical, and the evidence supports the combination of vigilant suctioning with throat packs to reduce the risk of aspirating blood, surgical debris, and foreign bodies [12].

Throat Packs, Gauze Barriers, and Oropharyngeal Protection

Throat packs and posterior gauze barriers provide a physical obstruction at the oropharyngeal isthmus and are particularly relevant when the rubber dam cannot be used, when the operative field is in the posterior maxilla or mandible, and when the procedure is performed under sedation or general anesthesia. A throat pack is defined as a semi-flexible or spongy material fitted behind the teeth or in the oropharynx to obstruct the pharynx and prevent aspiration or ingestion of debris such as tooth particles and dental materials [13]. The evidence supports the routine use of throat packs during dental treatment under general

anesthesia, particularly in children with special healthcare needs, where they reduce the risk of postoperative nausea and vomiting by preventing gastric aspiration of blood and debris [14]. In the non-anesthetized patient, a gauze pad placed at the posterior aspect of the mouth can trap small items such as implant drivers or crown fragments, and clinical guidance recommends this as a standard precaution when rubber dam isolation is not feasible [15].

Throat packs carry their own safety requirements. They must be inserted gently with appropriate instruments, such as Magill forceps, and must be counted and removed before the patient emerges from anesthesia or leaves the operatory [13]. A retained throat pack is itself a foreign-body hazard, and the team should treat pack insertion and removal as a formal checklist item with verbal confirmation between the operator and the assistant [15]. The same principle applies to gauze barriers: a gauze square placed in the posterior mouth can itself become dislodged and aspirated if it is not secured or continuously observed, which is why some clinicians prefer floss-tethered gauze or a commercially available throat guard that is less likely to migrate [16]. The choice among these devices should be based on the patient's anatomy, the procedure, and the team's ability to maintain visual and manual control of the barrier throughout the appointment [13].

Floss Ligatures and Instrument Security: The "Tether Everything" Principle

The tethering of small dental components with dental floss is a low-cost, high-yield strategy that is frequently mentioned in guidelines but inconsistently implemented in practice. Clinical guidance recommends tying dental floss to objects that can be dropped, such as implant drivers and rubber dam clamps, and where a sterile field is required, a suture thread with the needle removed may be used [3]. The pediatric dentistry literature likewise recommends floss ligatures on rubber dam clamps, cast crowns and bridges, elastic separators, and space maintainer appliances, while the endodontic safety literature emphasizes securing clamps and small instruments before intraoral placement [6][7]. The principle is simple: any object that is small enough to be swallowed or aspirated and is not physically attached to a larger handle or handpiece should be tethered to a floss ligature long enough to extend outside the mouth, allowing retrieval if it is dropped [7].

The effectiveness of floss ligatures depends on the team's adoption of a "tether everything" culture rather than on sporadic use. The 617-case review identified "no floss tie" as a documented cause in one reported aspiration case, and the broader case-report literature repeatedly describes aspiration of implant screwdrivers, crown fragments, and endodontic files that were not tethered [1]. Reported aspiration events during dental procedures reinforce that untethered small objects are a recurring hazard and that the tether is only useful if it is applied before the object enters the mouth [17]. The dental assistant can play a key role in this strategy by preparing floss ligatures before the procedure begins and by reminding the operator to secure any untethered component before it is placed in the mouth. A simple preoperative huddle—"What small objects will enter the field today, and how is each one secured?"—converts floss ligature from an individual idiosyncrasy into a team norm [3].

Table 2. Team-Based Mechanical and Procedural Strategies for Aspiration Prevention

Strategy	Mechanism of protection	Team member primarily responsible	Key implementation requirement
Rubber dam	Physical barrier excluding instruments and debris from oral cavity	Operator, with assistant preparation	Correct clamp selection; floss-tied clamp; documented justification if omitted [6][7]
High-volume evacuation	Continuous removal of debris and fluids at source	Chairside assistant	Dynamic tip positioning; continuous suction during high-risk steps [10]
Throat pack or gauze barrier	Oropharyngeal obstruction trapping debris	Operator and assistant	Formal insertion and removal count; gentle technique [13][16]
Floss ligature	Retrieval tether for small objects	Assistant prepares; operator applies	Pre-procedural identification of all tetherable objects [3][6]
Head rotation and semi-upright position	Gravity directs objects laterally rather than posteriorly	Assistant monitors; operator adjusts	Confirmed before treatment; adjusted across quadrants [3]

Pre- and post-operative object count	Detects unaccounted-for items before patient leaves	Assistant and operator	Verbal confirmation; documented in record [1]

Patient Positioning and Head Rotation

Patient positioning is a modifiable risk factor that is often overlooked because it is not a device or a technique in the conventional sense. The supine position reduces the protective effect of gravity and allows objects to fall posteriorly toward the pharynx, and the literature identifies supine positioning as a risk factor for aspiration and ingestion [18]. Clinical guidance recommends a reclined rather than fully supine position, rotation of the patient's head so that objects fall to the side of the mouth rather than toward the throat, and the use of a semi-upright posture whenever possible [3]. For patients at particularly high risk—those with obesity, pregnancy, gastroesophageal reflux, or a history of aspiration—a semi-upright or even upright position may be preferable, provided that the operator can maintain ergonomic access and visual control [18].

The team's role in positioning is twofold. First, the assistant or hygienist can confirm the chair angle before treatment begins and can adjust it as the procedure moves between quadrants. Second, the assistant can monitor the patient's head position and remind the operator to rotate the head when working in the posterior regions [3]. In pediatric patients, protective stabilization and the tell-show-do approach may be combined with positioning to reduce sudden movement, and in elderly patients with cervical spine limitations, pillow support and head rotation may be necessary to achieve a safe position without compromising the airway [6]. Positioning is thus a dynamic, team-coordinated variable rather than a one-time chair adjustment [18].

Preoperative Risk Assessment, Medical History, and Patient Communication

The effectiveness of any mechanical strategy is bounded by the quality of the preoperative assessment that precedes it. A thorough medical history should identify known aspiration risk factors: previous stroke, Parkinson's disease, motor neuron disease, multiple sclerosis, dementia, intellectual disability, psychiatric illness, alcohol dependence, gastroesophageal reflux, and current sedative or antipsychotic medication [3]. The history should also elicit previous episodes of choking, swallowing difficulty, or dental foreign-body events, because a prior event is a strong predictor of recurrence [5]. The possibility of silent aspiration is illustrated by an elderly patient who aspirated a foreign body without significant medical history and without typical presenting symptoms, reinforcing the need for careful preoperative questioning and a low threshold for imaging when an object is unaccounted for [19].

Preoperative assessment is also the point at which the team decides whether the planned procedure is appropriate for the outpatient setting. A patient with severe dysphagia, an unprotected airway, or a history of aspiration under sedation may require treatment in a hospital setting with anesthesia support, and the decision to refer should not be deferred until an incident occurs [5]. The team's administrative and scheduling staff contribute to this decision by flagging high-risk patients at the time of booking and ensuring that the appropriate equipment and personnel are available [3]. Informed consent should include a discussion of aspiration and ingestion risk, the preventive measures planned, and the emergency protocol that will be followed if an object is lost, because documentation of this discussion is both an ethical obligation and a medico-legal safeguard [16].

Emergency Preparedness and Post-Event Management as a Team Function

Even with optimal prevention, aspiration or ingestion can occur, and the effectiveness of the team is then measured by the speed and coordination of its response. The first step in suspected aspiration is to remove all materials from the oral cavity, position the patient upright, and encourage coughing to dislodge the object if the patient is conscious and breathing [16]. If the object is visible in the oropharynx, it may be retrieved with forceps under direct vision, but blind finger sweeps and probing with sharp instruments should be avoided because they can push the object deeper or cause injury [17]. If the patient is unable to breathe, standard basic life support and foreign-body airway obstruction protocols should be initiated immediately, and emergency services should be activated [18].

For ingestion, the patient should be reassured, the object should be identified and its material composition determined, and the patient should be referred for imaging and gastroenterological assessment [16]. Sharp or potentially hazardous objects require urgent endoscopic evaluation, whereas blunt objects may be managed conservatively with serial imaging, but the decision should be made by the receiving specialist rather than by the dental team in isolation [17]. When the object is not visible or its location is uncertain, an improvised dental radiographic technique can be used to support thoracic imaging and foreign-body detection

before definitive specialist assessment [20]. The team should provide the receiving facility with a description of the object, the time of the event, the procedure being performed, and the patient's clinical status [16]. A written record of the event, the object, the time, the response, and the follow-up plan is essential, both for the patient's care and for institutional learning [18].

Special Populations: Pediatric, Geriatric, and Medically Complex Patients

Pediatric patients require a distinct team approach because their airway anatomy, behavioral responses, and inability to cooperate with protective measures create a concentration of risk. Children under three years of age are at particularly high risk of aspiration, and the pediatric literature recommends rubber dam use during all restorative and endodontic procedures, floss ligatures on small appliances, and protective stabilization or sedation for children who cannot cooperate safely [6]. The team should use child-specific instruments, minimize procedure length, and employ a tell-show-do sequence to reduce sudden movements and gagging [6]. In children treated under sedation, the loss of protective reflexes makes continuous suction and throat packing even more important, and the case of an endodontic instrument aspirated after rubber dam omission under conscious sedation serves as a reminder that sedation is an additional risk factor rather than a substitute for mechanical barriers [9].

Geriatric patients present a different profile: reduced gag and cough reflexes, polypharmacy, xerostomia, cognitive impairment, and a higher prevalence of prosthodontic and implant components that can become dislodged [2]. The seven-year retrospective study found that the incidence rate increased rapidly among patients aged eighty years or older, and the expert consensus recommends preoperative screening of swallowing and cough reflexes, preferential use of chairside rapid-restoration techniques, and intermittent closed-mouth rest to reduce fatigue in elderly patients [5]. For patients with head and neck cancer after surgery or radiotherapy, the team should adjust the patient to a more upright position, use high-volume suction continuously, limit irrigant volume, and observe swallowing during the procedure, pausing if frequent coughing occurs [21]. Medically complex patients with aspiration pneumonia risk require coordinated dental intervention because oral pathogens and dental procedures can interact with pulmonary disease, and the team should plan treatment in consultation with the patient's physician when the airway risk is uncertain [21].

Team Communication, Briefings, and Structured Checklists

The human-factors literature on dental patient safety identifies communication breakdowns, absent or inconsistent checklists, and failure to double-check as recurrent contributors to adverse events, including foreign-body aspiration and ingestion [22]. The most effective preventive systems translate the strategies described above into a structured preoperative briefing and a standardized intraoperative checklist. A briefing need not be lengthy: a two-minute huddle before the patient is seated can confirm the patient's risk category, the isolation plan, the suction assignment, the tethering plan for small objects, the availability of a throat pack or gauze barrier, and the location of emergency equipment [22]. This briefing converts tacit knowledge into explicit team coordination and ensures that the assistant is not placed in the position of improvising a safety measure while the operator is already engaged in treatment [3].

A post-procedure debrief is equally important, particularly for high-risk cases and for any case in which an object was dropped but retrieved. The debrief should confirm that all instruments and materials are accounted for, that the throat pack or gauze barrier has been removed, and that the patient is stable before discharge [16]. If an object cannot be accounted for, the team should assume that it has been aspirated or ingested until imaging proves otherwise, and the emergency protocol should be activated without delay [18]. Documentation of the briefing, the object count, and the debrief creates an audit trail that supports both quality improvement and medico-legal defense [22].

Sedated and Anesthetized Patients: The Highest-Risk Team Scenario

Sedated and anesthetized patients require the most intensive combination of strategies because protective airway reflexes are depressed and the patient cannot cooperate with coughing or positioning. Procedural sedation in dentistry is associated with an increased risk of aspiration, and the team must therefore combine throat packing, continuous high-volume suction, careful pack counting, and a low threshold for using a rubber dam or an alternative pharyngeal shield [23]. The assistant's role becomes even more central in this setting, because the operator's attention is divided between the procedure and the patient's level of consciousness, and the assistant must continuously monitor suction, pack position, and the patient's breathing [23]. The team should also have a pre-planned route for escalation to anesthesia support and should confirm that emergency equipment is immediately available before sedation begins [16].

The combination of four-handed dentistry and rubber dam isolation is particularly effective in sedated patients because it creates two independent barriers: the dam excludes debris from the oral cavity, and the assistant's suction removes fluids and particles that accumulate around the dam [24]. When a throat pack is added, the team creates a third layer of protection, but it also adds a retained-pack risk that must be managed through formal counting and verbal confirmation [13]. The evidence therefore supports a layered approach in sedated patients rather than reliance on any single device, and the team should rehearse the sequence of dam placement, pack insertion, suction positioning, and pack removal until it becomes a standardized routine [24].

Synthesis: Why Team Strategies Outperform Individual Precautions

The evidence reviewed here supports a clear conclusion: the effectiveness of aspiration and ingestion prevention is not determined by the choice of a single device but by the consistency with which a layered, team-coordinated system is applied. The rubber dam is the most powerful single barrier, but it is omitted in exactly the situations where risk is highest—sedation, uncooperative patients, and posterior procedures—unless the team has a documented alternative plan [7]. High-volume suction is effective only when it is continuous and correctly positioned, which requires a dedicated assistant rather than an operator dividing attention between the handpiece and the evacuator [10]. Floss ligatures are inexpensive and reliable, but they are used only when the team makes tethering a preoperative norm [3]. Throat packs protect the pharynx but introduce a retained-pack hazard that demands formal counting and removal [13]. Patient positioning and head rotation are free, but they are forgotten when the team focuses exclusively on the operative field [18].

The common thread is redundancy. A well-functioning dental team does not rely on one safeguard; it builds multiple independent barriers so that the failure of one does not result in patient harm [24]. The assistant who continuously suctions , the operator who applies a floss-tied clamp, the hygienist who identifies a high-risk patient at the recall visit, and the administrator who ensures that a throat pack is available for a sedated case are all participating in the same preventive system [22]. When that system is reinforced by structured briefings, checklists, object counts, and regular simulation, the result is a measurable reduction in the probability that a small object will become an airway emergency [23]. The literature on human factors in dentistry consistently shows that adverse events cluster around communication failures and absent protocols, which means that the most effective intervention is not a new device but a change in team culture: a culture in which every small object is tethered, every high-risk patient is flagged, every barrier omission is justified and documented, and every near miss is reported and analyzed [22]. Finally, the published case reports and literature reviews on aspiration of dental items converge on a structured management algorithm that links prevention, early recognition, and post-event referral, and this algorithm provides the team with a single framework within which all of the strategies described above can be operationalized and audited [25].

Table 3. Team Training and Governance Matrix for Aspiration Prevention

Training domain	Dentist	Chairside assistant	Hygienist and administrative team
Risk screening and medical history	Primary responsibility	Contributes medication and allergy history	Flags high-risk patients at booking [22]
Rubber dam and alternative barriers	Application and clamp security	Preparation, floss ligature, suction	Ensures stock and equipment availability [24]
High-volume evacuation and four-handed technique	Coordinates field	Primary suction operator	Maintains equipment and tubing [10]
Object counting and documentation	Verifies count	Performs count and records	Audits records for completeness [16]
Emergency response and basic life support	Leads clinical response	Assists with retrieval and suction	Activates emergency services and retrieves protocol [18]
Simulation and incident review	Participates and leads debrief	Participates and reports near misses	Supports audit and scheduling of training [22]

CONCLUSION

Aspiration and swallowing of foreign objects during dental procedures are rare but potentially catastrophic events that are concentrated in identifiable high-risk patients and high-risk procedures. The evidence supports a comprehensive, team-based preventive strategy built on preoperative risk stratification, rubber dam isolation whenever feasible, continuous high-volume evacuation by a dedicated chairside assistant, throat packs or gauze barriers when isolation is incomplete, floss ligatures for all small objects, deliberate patient positioning and head rotation, structured briefings and object counts, and regular emergency training. No single measure is sufficient, and the effectiveness of each measure depends on the team's collective discipline in applying it consistently. The dental team that treats aspiration prevention as a shared system rather than an individual responsibility is the team that will most reliably keep small objects out of the airway and the gastrointestinal tract, and that will respond effectively when, despite all precautions, an object is lost.

REFERENCES

[1] Dionysopoulos D. Accidental ingestion and aspiration of foreign objects during dental practice. Stomatological Disease and Science. 2017 Sep 29;1:87-9.

[2] Huh J, Lee N, Kim KY, Jung S, Cha J, Kim KD, Park W. Foreign body aspiration and ingestion in dental clinic: a seven-year retrospective study. Journal of dental anesthesia and pain medicine. 2022 May 27;22(3):187.

[3] Cavanagh K. Tricky trends and toxicities: diverse applied epidemiology in NSW (Master's thesis, The Australian National University (Australia)).

[4] De Chiara MM, Attanasio ML, Boccadifuoco MF, Panico MA, Giordano MD, Russo MG. Silent threat: A case on dental drill head aspiration. Radiology Case Reports. 2025 1;20(5):2408-11.

[5] Umesan UK, Chua KL, Balakrishnan P. Prevention and management of accidental foreign body ingestion and aspiration in orthodontic practice. Therapeutics and clinical risk management. 2012 May 23:245-52.

[6] Alexander DR, Delhom Jr DJ. Rubber dam clamp ingestion, an operative risk: report of case. The Journal of the American Dental Association. 1971 Jun 1;82(6):1387-9.

[7] Hill EE, Rubel B. A practical review of prevention and management of ingested/aspirated dental items. Gen Dent. 2008 Nov 1;56(7):691-4.

[8] Fishelberg DG, Hook DD. Patient safety during endodontic therapy using current technology: a case report. Journal of endodontics. 2003 Oct 1;29(10):683-4.

[9] Mahesh R, Prasad V, Menon PA. A case of accidental aspiration of an endodontic instrument by a child treated under conscious sedation. European journal of dentistry. 2013 Apr;7(02):225-8.

[10] Ahmed S, Alotaibi KS, Binyahya FA, Albaijan IA, Alfaleh NA, Albaradie SI, Almotawa MF, Alshakaki NT, Softah NA, Tabassum N, Alafaliq F. Awareness and Practice of Infection Control Protocol Amid Covid-19 Pandemi in Private Dental Clinics in Saudi Arabia. Journal of Pharmaceutical Research International. 2021 Jan 18;32(42):1-7.

[11] Hegde MN, Parmar G, Logani A, Hegde ND, Ballal S, Krithikadatta J, Nawal R, Amalavathy K, Devadiga D, Bhat R. Dental practice management during COVID-19 times—Now and beyond. International Journal of Clinical Practice. 2021 Sep;75(9):e14251.

[12] Álvarez ZC, Tovar NC, Colina TC, Lancheros ML, Bolaños NC, Rodríguez JG, Torres MI, González LL, Soto MA, Jiménez DE, Ocampo PE. Four-Handed Technique in Dental Education: Integrative Review. Universitas Odontológica. 2021;40:1-1.

[13] Bedolla CN. Airway Management: Review of Current Devices and Development of a Novel Endotracheal Tube For Emergency Combat Care. The University of Texas at San Antonio; 2022.

[14] Tetiker S, Akdogan HN, Alpay N, Dogan MC. Effect of Dental Throat Pack Used Under General Anesthesia in Children with Special Healthcare Needs on Postoperative Nausea, Vomiting, and Sore Throat: A Randomized Clinical Trial. Journal of Clinical Medicine. 2025 Jan 17;14(2):567.

[15] Athanassoglou, V., Patel, A., McGuire, B., Higgs, A., Dover, M.S., Brennan, P.A., Banerjee, A., Bingham, B. and Pandit, J.J., 2018. Systematic review of benefits or harms of routine anaesthetist-inserted throat packs in adults: practice recommendations for inserting and counting throat packs: An evidence-based consensus statement by the Difficult Airway Society (DAS), the British Association of Oral and Maxillofacial Surgery (BAOMS) and the British Association of Otorhinolaryngology, Head and Neck Surgery (ENT-UK). Anaesthesia, 73(5), pp.612-618.

[16] Hill EE, Rubel B. A practical review of prevention and management of ingested/aspirated dental items. Gen Dent. 2008 Nov 1;56(7):691-4.
[17] Son YJ, Ha BG, Jeon JH. Foreign body aspiration during dental procedure. The Journal of the Korean dental association. 2012;50(12):755-62.
[18] Eroglu O, Algan-Kaya H, Coskun F. A potentially fatal complication that may occur during dental treatment:"foreign body aspiration". The Pan African Medical Journal. 2015 Jan 14;20:36.
[19] Mistry N, Kufta K, Mupparapu M, Panchal N. Foreign Body Aspiration in an Elderly Male with No Significant Medical History. Dental Clinics of North America. 2023 Apr 21;67(3):511-4.
[20] Jogigowda MS, Patil MK, Saha BA, Christopher BV. When Dentistry Meets Emergency: An Improvised Dental Radiographic Technique for Thoracic Imaging in Foreign Body Detection and Retrieval in Real Time. Journal of Radiology Nursing. 2025 1;44(3):331-4.
[21] Kunitomi T, Miyagami T, Teranaka S, Matsumoto T, Yoshimatsu Y, Matsumoto S, Yamaguchi K, Morikawa T, Naito T. Current State and Challenges of Dental Intervention in Aspiration Pneumonia Management from the Perspective of Hospitalists: A Cross-Sectional Survey in Japan. International Journal of General Medicine. 2025 31:6889-98.
[22] Wright S, Crofts G, Ucer C, Speechley D. Errors and adverse events in dentistry–a review. Dental Update. 2017 Nov 2;44(10):979-82.
[23] Hara T, Ozawa A, Shibutani K, Tsujino K, Miyauchi Y, Kawano T, Ito K, Sakai H, Yokota M, Working Group for the Preparation of Practical Guidelines for Safe Sedation, Safety Committee of the Japanese Society of Anesthesiologists. Practical guide for safe sedation. Journal of Anesthesia. 2023 Jun;37(3):340-56.
[24] Jacob KC, Gopi A, Maurya R, Jayan B, Londhe SJ, Mukherjee M, Mitra R, Singla NK, Nehra K, Shaikh PH, Babu BK. Dental practice in a pandemic scenario: The journey from lockdown to a new reality. Journal of Dentistry Defense Section. 2020 Jul 1;14(2):66-74.
[25] Araujo SC, Bustamante JE, de Souza AA, Peixoto LC, Amaral MB. Aspiration of dental items: case report with literature review and proposed management algorithm. Journal of Stomatology, Oral and Maxillofacial Surgery. 2022 Sep 1;123(4):452-8.