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The Mouth–Airway Connection: Anesthetic and Airway Considerations in Patients Undergoing Oral and Maxillofacial Procedures

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ABSTRACT

Oral and maxillofacial procedures present distinctive anesthetic challenges because the operative field and upper airway are anatomically contiguous. Surgical manipulation, bleeding, secretions, edema, distorted anatomy, instrumentation, and postoperative fixation may compromise airway patency. Safe management therefore requires preoperative assessment, anticipation of difficult ventilation or intubation, selection of a technique compatible with surgical access, continuous monitoring, and planned extubation.

Orotracheal and nasotracheal intubation remain important techniques, while supraglottic devices may be suitable in selected procedures. Submental intubation can provide an alternative when oral and nasal tubes interfere with surgical access and tracheostomy is undesirable. Procedural sedation adds risk because airway tone may decrease while the mouth is occupied by instruments; capnography may facilitate earlier detection of apnea and hypoventilation. Patients with obstructive sleep apnea, maxillofacial trauma, craniofacial abnormalities, head and neck tumors, or restricted mouth opening require particular attention.

This narrative review examines preoperative airway assessment, difficult-airway management, airway-device selection, nasotracheal and submental intubation, procedural sedation, intraoperative airway protection, extubation, postoperative monitoring, and multidisciplinary airway planning in oral and maxillofacial surgery.

Keywords: Airway Management; Anesthesia, Maxillofacial Surgery, Difficult Airway, Nasotracheal Intubation, Submental Intubation

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ABBREVIATIONS

ASA: American Society of Anesthesiologists

OSA: Obstructive Sleep Apnea

INTRODUCTION

The contemporary difficult-airway approach emphasizes anticipation, preparation, oxygenation, limitation of repeated attempts, and early transition to alternative airway techniques when difficulty is encountered [1,2]. The 2022 American Society of Anesthesiologists practice guideline further emphasizes individualized airway planning according to the anticipated difficulty of ventilation, intubation, aspiration risk, and the patient's ability to tolerate apnea [1].

THE MOUTH–AIRWAY RELATIONSHIP

The oral cavity represents an important component of the upper airway and provides a major route for airway instrumentation during anesthesia. Reduction in upper-airway muscle tone during sedation and general anesthesia can promote posterior displacement of the tongue and pharyngeal soft tissues, particularly in susceptible patients [3,4].

The surgical environment can further modify this relationship. Retractors, surgical packs, fixation devices, intraoral bleeding, and edema can reduce access to the oral airway and complicate emergency airway intervention [5-7].

In maxillofacial trauma, hemorrhage, tissue prolapse, edema, altered anatomy, and associated cervical injuries may simultaneously compromise airway patency and make airway instrumentation more difficult [5-7]. A retrospective study of 177 patients demonstrated the diversity of airway-management requirements in maxillofacial trauma and emphasized that airway management must be individualized according to injury pattern and operative requirements [8,9].

Thus, the airway should be regarded as part of the surgical anatomy rather than as an independent anesthetic structure.

PREOPERATIVE AIRWAY ASSESSMENT

Clinical History

Preoperative assessment should include previous difficult intubation, difficult mask ventilation, prior airway-related complications, obstructive sleep apnea, snoring, previous tracheostomy, head and neck surgery, radiotherapy, cervical spine disease, temporomandibular joint dysfunction, restricted mouth opening, and craniofacial abnormalities [1-4].

Obstructive sleep apnea deserves particular attention because sedative and anesthetic drugs can exacerbate upper-airway obstruction and respiratory depression [3.10]. Studies in oral and maxillofacial surgical populations indicate that OSA risk may be clinically relevant and that systematic screening can identify patients requiring additional perioperative precautions [10,11].

Patients with head and neck tumors require additional assessment for tumor-related airway narrowing, trismus, distorted anatomy, previous radiotherapy, fibrosis, and restricted neck movement. Awake airway techniques may be considered when conventional induction is expected to place the patient at unacceptable risk [12].

Physical Examination

Airway assessment should include mouth opening, Mallampati classification, thyromental distance, mandibular protrusion, neck mobility, dentition, facial symmetry, nasal patency, and evidence of intraoral or neck pathology.

Restricted mouth opening is particularly important because it can influence both direct laryngoscopy and the insertion or function of supraglottic airway devices. Sanuki et al. [13] evaluated the relationship between mouth opening and laryngeal mask airway function during oral surgery, demonstrating the importance of adequate oral access for successful device placement and function.

DIFFICULT AIRWAY MANAGEMENT

Difficult airway management represents one of the central anesthetic problems in oral and maxillofacial surgery [2,15]. The problem may arise from restricted mouth opening, facial deformity, trauma, cervical abnormalities, tumors, airway edema, or altered surgical anatomy.

The 2022 ASA guideline recommends a structured approach to difficult-airway management, including consideration of awake airway management when difficult ventilation or intubation is anticipated or when the patient may not tolerate apnea [1].

In patients with maxillofacial trauma, the airway may be simultaneously obstructed and anatomically distorted [5-7] Consequently, repeated conventional laryngoscopic attempts may increase trauma and delay definitive airway control.

A multidisciplinary approach involving anesthesia, oral and maxillofacial surgery, trauma, and, when appropriate, otolaryngology is recommended [5-7].

Alternative techniques include videolaryngoscopy, flexible bronchoscopic intubation, supraglottic devices, awake intubation, submental intubation, and surgical airway access [1,2,15].

OROTRACHEAL INTUBATION

Orotracheal intubation remains a straightforward and effective technique for many oral and maxillofacial procedures. However, the tube may interfere with intraoral surgical access, dental occlusion assessment, intermaxillary fixation, and some reconstructive procedures [16].

Supraglottic airway devices have also been described for selected oral and maxillofacial procedures. Their applicability depends on aspiration risk, surgical access, duration of surgery, and the extent of intraoral manipulation [13,17].

The laryngeal mask airway has been specifically evaluated in oral and maxillofacial surgery as an alternative airway technique, with principal considerations including maintenance of airway patency, aspiration risk, and minimization of interference with surgery [17].

In procedures involving substantial bleeding, contamination, or aspiration risk, a cuffed endotracheal tube generally provides more reliable airway protection than a supraglottic device.

NASOTRACHEAL INTUBATION

Nasotracheal intubation is widely used in oral and maxillofacial surgery because it leaves the oral cavity relatively unobstructed [16]. A review by Prasanna and Bhat described nasotracheal intubation as a common technique for oral surgical procedures and discussed its indications, contraindications, techniques, and complications [16].

Nasotracheal intubation has also been evaluated in major oral cavity reconstruction. In a retrospective cohort of 141 patients undergoing free-tissue transfer for oral cavity, maxillary, or mandibular defects, nasotracheal intubation was associated with favorable postoperative outcomes compared with tracheostomy, although the observational design limits causal interpretation [18].

The principal complications of nasotracheal intubation include epistaxis, mucosal trauma, turbinate injury, sinus-related complications, and tube obstruction or displacement [16].

Techniques intended to facilitate nasal passage and reduce trauma have also been investigated. Mechanical dilation of the nasal passage has been studied in relation to nasotracheal intubation, although mechanical dilation does not necessarily eliminate mucosal trauma or bleeding [19].

More recent studies have evaluated the use of nasopharyngeal airways to facilitate nasotracheal intubation, reflecting continuing interest in techniques that improve tube passage [20].

SUBMENTAL INTUBATION

Submental intubation was introduced as a technique that provides a secure tracheal airway while avoiding interference with the oral and nasal surgical fields [21]. The original technique described passage of the endotracheal tube through a submental incision into the oral cavity and was proposed as an alternative to tracheostomy [21].

It is particularly useful in selected patients with complex maxillofacial trauma in whom oral intubation interferes with surgical manipulation and nasal intubation is contraindicated or undesirable [22-25].

A systematic review of 116 eligible publications involving 2,229 patients found that trauma accounted for the majority of reported indications and that submental intubation was generally associated with a low complication rate [22].

Clinical series have demonstrated that submental intubation can allow simultaneous fracture reduction, fixation, and intraoperative assessment of dental occlusion without the tube occupying the oral or nasal surgical field [23,24].

A prospective study likewise evaluated submental intubation as an airway technique for maxillofacial surgery and supported its use in appropriately selected cases [24].

SUBMENTAL INTUBATION VERSUS TRACHEOSTOMY

The principal rationale for submental intubation is that it can provide temporary intraoperative airway control without requiring a formal tracheostomy [22,25].

Several reports describe its use as an alternative in complex maxillofacial trauma, particularly when nasotracheal

intubation is inappropriate and prolonged postoperative ventilation is not expected [23,25].

A retrospective review of 45 cases reported that submental intubation provided secure airway control while avoiding interference with maxillomandibular fixation and access to naso-orbito-ethmoid fractures [25].

However, submental intubation should not be considered a universal replacement for tracheostomy. Patients requiring prolonged postoperative ventilation, patients with severe airway obstruction, and selected oncologic or reconstructive cases may still require a formal surgical airway.

The decision should therefore be based on expected duration of ventilation, airway pathology, operative access, associated injuries, and institutional expertise [22,25].

MAXILLOFACIAL TRAUMA AND THE EMERGENCY AIRWAY

Maxillofacial trauma presents a particularly complex airway problem. Hemorrhage, edema, tissue prolapse, loose teeth, foreign material, and anatomical distortion may compromise airway patency [5-7].

Associated cervical spine injuries and aspiration risk may further complicate airway management [5,6]. The airway should therefore be assessed and secured according to trauma principles while simultaneously considering the definitive surgical requirements [5-7].

Submental intubation can be particularly useful in panfacial trauma when both oral and nasal routes interfere with fracture reduction or are contraindicated [23,25].

Contemporary clinical literature continues to emphasize that airway management in maxillofacial trauma involves challenges not only during initial intubation but also during maintenance, extubation, and postoperative surveillance [26].

PROCEDURAL SEDATION IN ORAL SURGERY

Oral surgery is frequently performed under local anesthesia with minimal or moderate sedation. However, increasing sedation depth can result in loss of upper-airway tone, hypoventilation, apnea, and airway obstruction [27-29].

The problem is particularly relevant because the oral cavity may simultaneously contain surgical instruments, suction devices, retractors, or packs, potentially limiting immediate airway access.

Evidence from dental sedation studies supports enhanced respiratory monitoring. Brady et al. [27] evaluated microstream capnography during midazolam sedation for oral surgery in a randomized controlled trial.

Takaya et al. [28] similarly evaluated capnography during dental sedation and reported improved detection and prevention of hypoxic events.

A systematic review and meta-analysis involving procedural intravenous sedation found that capnography was associated with improved detection of respiratory compromise compared with standard monitoring [29].

CAPNOGRAPHY AND AIRWAY MONITORING

Pulse oximetry remains essential for monitoring oxygenation but may not provide immediate information regarding ventilation, particularly when supplemental oxygen is administered.

Capnography provides continuous information regarding exhaled carbon dioxide and can identify apnea or hypoventilation before significant oxygen desaturation develops [27-29,30].

A meta-analysis by Waugh et al. [30] demonstrated that capnography enhances detection of respiratory events during procedural sedation.

For oral and maxillofacial procedures performed under sedation, capnography is particularly relevant because access to the airway may be restricted by the surgical field.

HEAD AND NECK ONCOLOGY

Head and neck malignancy can substantially alter the normal airway. Tumor mass, edema, bleeding, fibrosis, previous surgery, previous radiation, and trismus can all contribute to difficult airway management.

Awake flexible techniques may be useful in selected patients with anticipated difficult airways. Huitink et al. [12] described awake fibrecapnic intubation in head and neck cancer patients with difficult airways, emphasizing preservation of spontaneous respiration during airway instrumentation.

In these patients, the anesthetic plan should be individualized according to the location and extent of disease, airway patency, mouth opening, previous treatment, and anticipated surgical requirements.

OBSTRUCTIVE SLEEP APNEA

OSA is particularly relevant to oral and maxillofacial anesthesia because airway obstruction may worsen with sedatives, opioids, and general anesthesia [3,10].

Preoperative screening using tools such as STOP-Bang can identify patients at increased risk [10,11] In an office-based oral surgery population, assessment using STOP-Bang demonstrated that OSA risk is clinically relevant in patients presenting for anesthesia [10].

Patients with significant or poorly controlled OSA may require enhanced postoperative monitoring and careful opioid-sparing analgesia [3,11].

INTRAOPERATIVE AIRWAY CONSIDERATIONS

The airway should be reassessed continuously throughout the operation. Surgical manipulation, head positioning, retractors, intraoral packs, and movement of the patient can alter tube position. Blood and secretions can obstruct the airway or compromise visualization. In trauma cases, edema may increase throughout the operation [5-7].

When maxillomandibular fixation is applied, access to the oral cavity becomes restricted. This makes preoperative planning for emergency airway access particularly important [5-7].

The anesthesiologist and surgeon should therefore establish a clear airway plan before induction, including the planned route of intubation, tube position, anticipated surgical interference, and strategy for airway rescue.

EXTUBATION AND POSTOPERATIVE AIRWAY MANAGEMENT

Extubation represents a second major phase of airway management. Postoperative edema, bleeding, secretions, residual anesthetic effects, opioid-induced respiratory depression, and maxillomandibular fixation can compromise airway patency [5-7].

Patients undergoing major maxillofacial surgery may experience postoperative respiratory and airway-related complications, particularly when extensive tissue manipulation or postoperative swelling is present [26].

The decision to extubate should therefore incorporate assessment of airway edema, respiratory function, neuromuscular recovery, consciousness, bleeding, surgical anatomy, and the anticipated difficulty of reintubation.

Patients with significant airway edema, severe OSA, extensive trauma, or prolonged complex surgery may require delayed extubation and postoperative critical-care observation.

MULTIDISCIPLINARY AIRWAY PLANNING

The mouth–airway relationship requires close communication between anesthesiologists and oral and maxillofacial surgeons [5-7]. For complex trauma, oncologic surgery, reconstructive procedures, and anticipated difficult airways, the airway plan should be established before induction.

The team should consider:

- anticipated difficulty of mask ventilation.
- anticipated difficulty of intubation.
- need for awake intubation.
- nasal versus oral access.
- possible need for submental intubation.
- potential need for tracheostomy.
- aspiration risk.
- intraoperative bleeding.
- maxillomandibular fixation.
- postoperative airway edema.
- extubation strategy; and.
- rescue airway plan

This approach is consistent with contemporary difficult-airway guidance emphasizing advance planning and a structured pathway for anticipated and unanticipated difficulty [1,2].

DISCUSSION

The available literature demonstrates that oral and maxillofacial surgery creates a distinctive interaction between airway management and surgical access [5-7]. The operative field may directly occupy the anatomical region required for airway instrumentation, while surgical pathology can simultaneously make the airway more difficult to access.

Three principles emerge. First, airway assessment must precede induction. Conventional airway predictors should be combined with assessment of surgical pathology, previous airway history, mouth opening, nasal anatomy, cervical mobility, and expected operative requirements [1,2].

Second, airway technique should be procedure-specific. Nasotracheal intubation provides excellent oral access for many procedures, whereas submental intubation offers an alternative when both oral and nasal tubes interfere with surgery [16,22–25]

Third, airway management extends beyond intubation. Sedation monitoring, intraoperative tube security, aspiration prevention, extubation, and postoperative observation are all components of perioperative airway management [27-30].

The role of capnography during sedation is particularly important. Evidence indicates that capnography can identify respiratory depression and apnea earlier than standard monitoring alone and may reduce clinically significant respiratory compromise during procedural sedation [27-30].

Similarly, modern difficult-airway guidelines emphasize anticipation and preparation rather than repeated attempts at a single technique [1,2].

FUTURE DIRECTIONS

Future research should focus on procedure-specific airway algorithms for major categories of oral and maxillofacial surgery.

Comparative studies examining videolaryngoscopy, flexible bronchoscopy, nasotracheal techniques, submental intubation, supraglottic devices, and surgical airways may help refine patient selection.

Further investigation is also needed regarding postoperative extubation protocols after major maxillofacial surgery, particularly in patients with extensive edema, OSA, maxillomandibular fixation, and head and neck malignancy.

In office-based oral surgery, additional prospective research should evaluate capnography, sedation depth, patient selection, rescue airway strategies, and adverse-event prevention [27-29,10].

CONCLUSION

The mouth and airway should not be considered independent anatomical and anesthetic entities during oral and maxillofacial procedures. Their proximity creates a unique perioperative environment in which surgical access, airway security, ventilation, aspiration prevention, and postoperative recovery are closely interconnected.

Comprehensive preoperative assessment, individualized airway selection, anticipation of difficult airway management, appropriate respiratory monitoring, meticulous intraoperative airway protection, and planned extubation are essential components of safe care [1,2].

Nasotracheal intubation remains valuable for procedures requiring unobstructed oral access, whereas submental intubation provides an effective alternative in appropriately selected cases [16,22-25]. Capnography provides additional respiratory information during procedural sedation and may facilitate earlier recognition of respiratory compromise [27-30].

Ultimately, successful management of the mouth–airway connection requires a multidisciplinary approach involving anesthesiology and oral and maxillofacial surgery, with the airway strategy determined by both patient anatomy and surgical requirements.

AUTHOR CONTRIBUTIONS

AMV: conceptualization, literature review, drafting, critical revision, and final approval of the manuscript.

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