Occasional Review

Anaesthetic implications of temporomandibular joint disease

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The purpose of this article is to review the functional anatomy of the temporomandibular joint (TMJ) mechanism in man, to discuss the various types of TMJ dysfunction and to suggest a plan for assessment, anaesthesia and airway management when reconstructive or unrelated surgery is required. Patients with restricted mouth opening, who require critical care treatment of severe upper airway obstruction or impending ventilatory failure are a special risk group. Regional anaesthesia or the use of a laryngeal airway should be considered. When tracheal intubation is essential and mouth opening is less than 25 mm, it is unlikely that the larynx will be visualized by direct laryngoscopy. Fibreoptic intubation is then indicated. All patients with severe TMJ dysfunction require assessment by an oral surgeon.

Le but de cet article est de reviser l'anatomie fonctionnelle du mécanisme de l'articulation temporomandibulaire (TMJ) chez l'homme, de discuter les différentes sortes de dysfonctionnements du TMJ et de suggérer une conduite à tenir face aux voies respiratoires, à l'évaluation et à l'anesthésie lors d'une chirurgie de reconstruction ou lors de toute autre chirurgie. Les patients qui présentent une ouverture restreinte de la bouche, qui ont besoin de soins critiques lors d'une obstruction sévère des voies respiratoires supérieures ou lors d'une défaillance ventilatoire imminente, font partie d'un groupe spécial à risque. L'anesthésie régionale ou l'utilisation d'un masque laryngé devrait être considérées. Lorsque l'intubation endotrachéale est essentielle et que l'ouverture de la bouche est moins de 25 mm, il est peu probable que le larynx soit visualisé par laryngoscopie directe. Une intubation à l'aide d'un bronchoscope à fibres optiques est alors indiquée. Tous les patients avec un dysfonctionnement sévère du TMJ nécessitent une évaluation par un chirurgien buccal.

Key words
COMPLICATIONS: intubation, tracheal;
INTUBATION, TRACHEAL: complication.

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Assessment of TMJ function should be done routinely before any intervention in the upper airway. The presence of pain, restricted movement, hypermobility or swelling in one or both TMJs demands that a more detailed history be taken and the TMJ mechanism examined closely before proceeding (Table I).

Knowledge of the anatomy, physiological ranges of movement, and insight into the more common pathology affecting TMJs is useful in deciding the cause of abnormalities and their severity. Questions concerning special precautions or techniques needed to manage the patient's airway successfully without exacerbating TMJ dysfunction and the place of specialist consultations or special investigations may then be answered.

Jaw thrust and direct laryngoscopy manoeuvres are routinely done on anaesthetized, heavily sedated or obtunded patients, situations where the TMJs have lost some of the protection afforded by tone of surrounding muscles. This is especially true when myoneural blocking drugs have been used. Normal individuals may develop temporary TMJ dysfunction following uncomplicated direct laryngoscopy and endotracheal intubation.[1] Manipulations involving the upper airway should be firm but gentle.

The assessment of TMJ should have a similar degree of importance to that of checking the integrity of the cervical spine prior to airway management. It should identify the small but important group of patients who will fail conventional airway management and will need fibreoptic bronchoscopic assisted intubation or other strategies that require preparation and planning. The purpose of this review is to describe the pathology of the TMJ and its relevance for the anaesthetist.

TABLE I Symptoms and signs of (TMJ) disorders

(A) History
- Pain
  - Preauricular
  - Intraauricular
  - Facial
  - Temporal/frontal headache
- Joint Noises
  - clicking
  - popping
- Diminished mouth opening
- Locking
  - open
  - closed
- Previous trauma

(B) Examination
1 Inspection
- Facial assymetry
- Alteration in jaw opening
  - Range of motion
    - Full
    - Restricted
    - None
    - Hypermobility
  - Path of opening
    - Straight
    - Deviated
    - Deflected
  - Swelling and erythema

2 Palpation
- Tenderness
  - localized over the joint
  - diffuse over muscles
- Crepitus
  - on opening

3 Ausculation
- Joint noises
  - clicking
  - crepitus
  - popping

Anatomy and range of movement in the TMJ

Normal TMJ function depends upon coordinated contractions of masticatory muscles acting on an intact condyle disc complex. Opening of the mouth is largely a passive process involving relaxation of most masticatory muscles, except the lateral pterygoids and suprahyoid muscles, which contract and pull the mandibular condyle forward. Initially, suprahyoid muscles contract causing rotation between the condyle and the inferior surface of the articular disc. This permits the first 20 mm or so of opening, then a forward translational movement of the superior disc surface and condyle aided by the lateral pterygoid muscles allows a further 25 mm of opening (Figures 1 and 2). Sudden inappropriate contraction of the lateral pterygoids (Figures 3 and 4) when the mouth is widely opened (as in yawning) can produce dislocation.

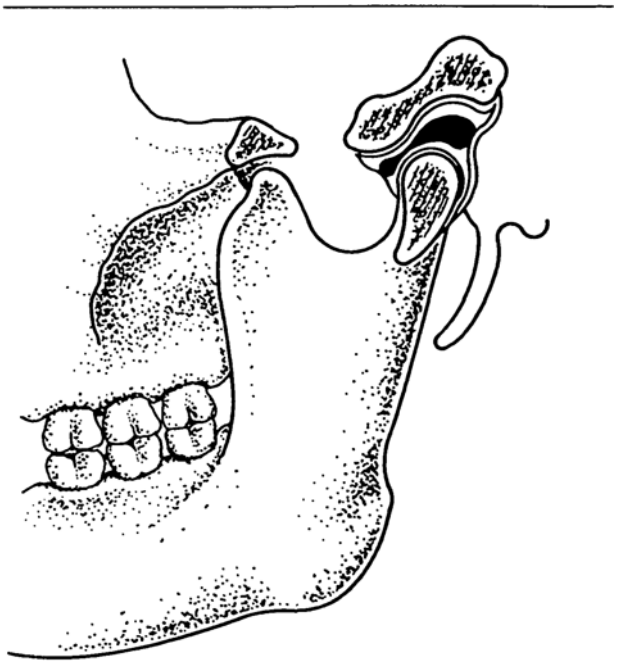

FIGURE 1 Closed normal.

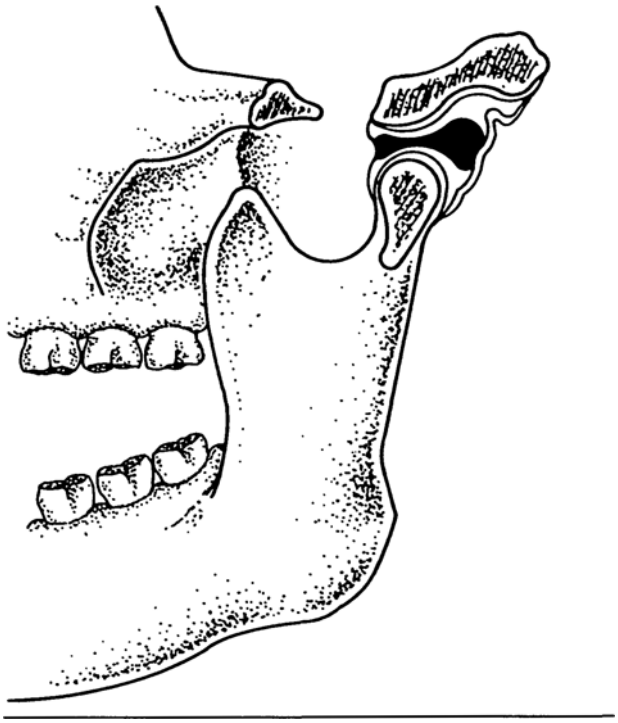

FIGURE 2 Open normal. Shows rotation and translation of the condyle.

Closing of the mouth is accompanied by contraction of the elevator muscles, which include the medial pterygoids, superficial fibres of the masseter and anterior fibres of the

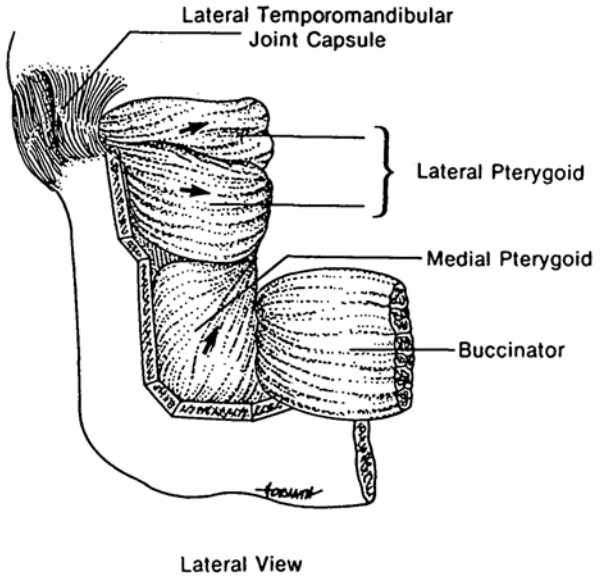

FIGURE 3 Masseter and portion of ramus cut away. Shows protrusive action of lateral pterygoid.

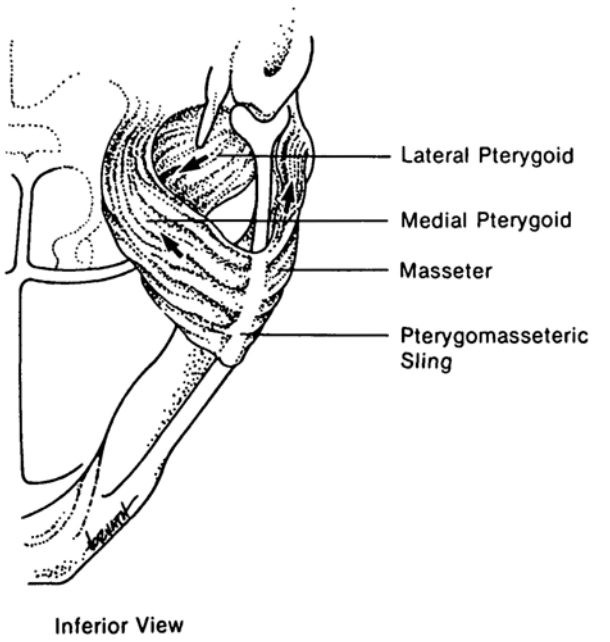

FIGURE 4 Right side of mandible. Shows elevating action of masseter and medial pterygoid muscles, lateral pull of lateral pterygoid muscle.

temporalis muscles. Activation of posterior temporalis and deep masseter muscle fibres produces mandibular retrusion (Figure 5). Longstanding muscle spasm, inflammation or mandibular immobility can lead to contracture of the elevator muscles and a permanent state of limited mouth opening. Secondary contracture of the capsular ligaments of the joint is likely present in such cases.

The attached ligaments illustrated in Figure 6 and the suprahyoid muscles help to stabilize the joints. Rarely, ossification can occur in these ligaments and leads to restricted movement.

Articular disc displacement (Figures 7 and 8) causes clicking and intermittent impairment of mouth opening. Severe anterior disc displacements can cause the mouth to lock in the closed position. It is unlikely that this would occur during the course of airway management, but it has been reported.[2]

TMJ disorders (Table II)

Muscle disorders

SPLINTING

This is a state of hypertonicity developing in masticatory muscles that have undergone a recent change in sensory or proprioceptive nerve input. It most often follows dental treatment especially treatment that has induced an occlusal abnormality. There is diffuse tenderness over the muscles involved and muscle pain intensified by movement of the jaw. Mouth opening is only restricted because of pain.

TABLE II TMJ disorders

1 Muscle disorders
- Splinting
- Spasm
- Inflammation

2 Disorders of disc condyle complex
- Anterior disc displacement with reduction (clicking)
- Anterior disc displacement without reduction (closed lock)

3 Inflammatory disorders
- Synovitis & capsulitis
- Retrodiscitis
- Arthritis
  - Traumatic
  - Degenerative
  - Infective
  - Rheumatoid

4 Dislocation

5 Chronic hypomobility
- Contracture of elevated muscles
- Capsular fibrosis
- Ankylosis
  - Fibrous
  - Bony

6 TMJ trauma

7 Disease causing soft tissue rigidity
- Deep space infections of head and neck
- Scarring from facial burns
- Induration from radiotherapy
- Tumours infiltrating soft tissue

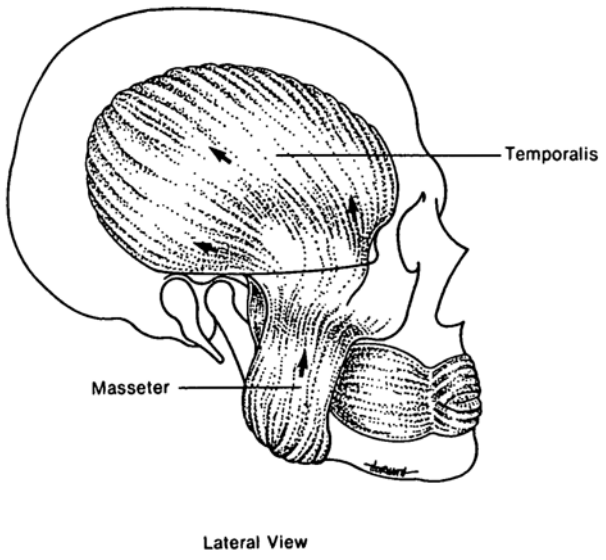

FIGURE 5 Lateral view showing elevator and retruding muscles of the mandible.

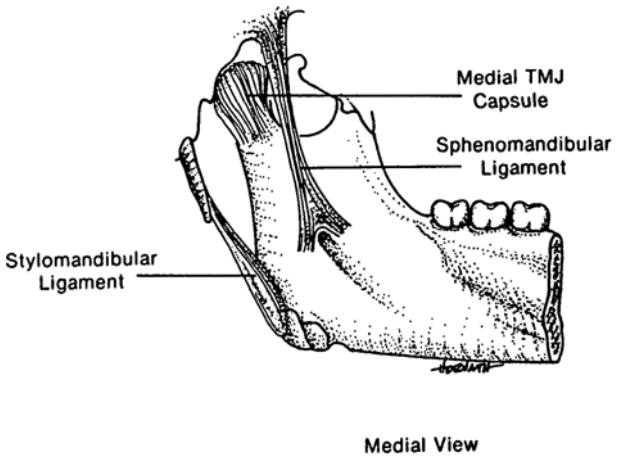

FIGURE 6 Capsular, sphenomandibular and stylomandibular ligaments help to stabilize the TMJ.

Symptoms are usually of acute onset and short duration. Untreated it may lead to muscle spasm.

SPASM

Is a more severe and protracted hypertonic state of masticatory muscles, sometimes the result of untreated splinting, medication with drugs that produce Parkinsonian side effects or can be triggered by referred pain from a site within the area of distribution of the trigeminal nerve. This disorder which produces sharp spasms of pain is intensified by emotional stress.

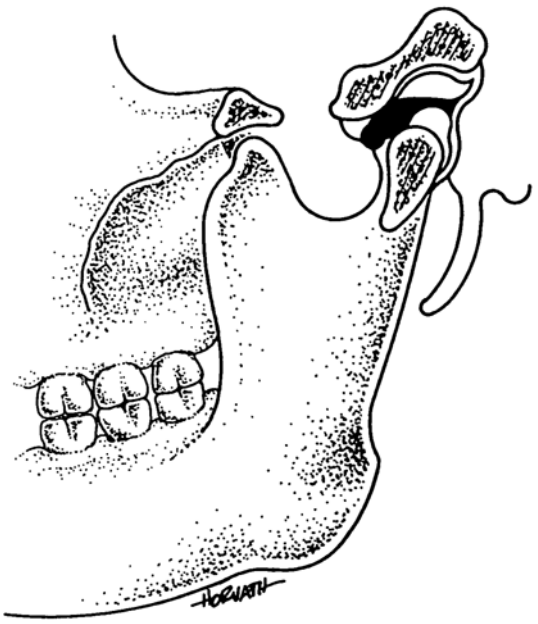

FIGURE 7 Anterior disc displacement (mouth closed).

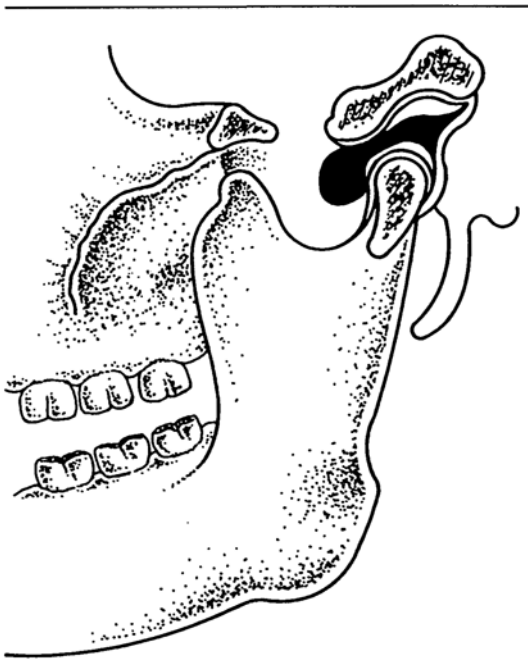

FIGURE 8 Translation is blocked by the disc. Anterior disc displacement without reduction.

INFLAMMATION

Masticatory muscles can become stiff and swollen as the consequence of trauma, or untreated muscle spasm. Myositis can also result from an extension of an inflamma-

tory process in adjacent tissue. Trismus will result when the elevator muscles are involved. Severe and long-standing muscle inflammation could produce a degree of fixed restriction in mouth opening.

Disorders of the disc condyle complex

Tissue damage or structural incompatibilities of the disc condyle complex may lead to hyper or hypo mobility of the TMJ. These structural incompatibilities may be secondary to macro trauma, micro trauma (such as prolonged malocclusion) or abusive habits (such as teeth grinding) or to inherent weakness in the joint capsule and ligaments.

DISC DISPLACEMENT

Initially moderate anterior disc displacement will result in a painful clicking joint. Mouth opening is limited only by pain. With progressive disease the disc is displaced more anteriorly and may produce a closed lock in which there is a fixed resistance to opening of the mouth that may or may not be overcome by manipulation of the jaw. It is unusual for such a joint to lock during the course of airway management.

Inflammatory disorders

An inflammatory process in the TMJ will produce symptoms and signs similar to those found in synovitis or arthritis affecting other synovial joints. The specific disease process in each case needs to be identified and treated appropriately. Joint pain, swelling limited movement, high intra-articular pressure as well as radiological changes in the joint space or surrounding tissues may be present.

Dislocation

This occurs when the mandibular condyle prolapses anteriorly over the articular eminence and is completely displaced forward of the articular fossa. Displacement of the articular disc behind the head of the condyle contributes to the obstruction to closing. When dislocation is present the patient's mouth is widely open, only the molar teeth are in opposition and the mouth cannot be closed.

Yawning or wide opening of the mouth makes the joint vulnerable to dislocation as the ligaments supporting the articular disc are most lax at this time. In this position a sudden inappropriate contraction of the lateral pterygoid muscles or a forceful forward pull during jaw thrust or laryngoscopy will precipitate dislocation in a susceptible individual. Dislocation can be unilateral or bilateral.

To reduce a dislocation heavy sedation or general anaesthesia is recommended. Exert downward and slightly forward pressure on the external oblique ridge of the mandible. This allows the condyle to retrude back into the articular fossa.

Dislocation sometimes recurs in the same patient.

Chronic hypomobility (fixed restriction to mouth opening)

Several conditions may lead to a permanent reduction in mouth opening (chronic hypomobility). Elevator muscle contracture which results from prolonged inability to open (e.g., intermaxillary fixation) leads to decreased length of these muscles. Infection in the maxillofacial region or repeated dental injections may lead to fibrous tissue formation, restricting muscle mobility. The resulting restriction in movement may become permanent unless prompt, extensive physiotherapy is instituted.

Temperomandibular joint ankylosis may result from fibrous or bony intraarticular ossification or from extra-articular sources such as an enlarged coronoid process (pseudoankylosis). Patients with decreased mouth opening and limited movements in lateral and protrusive directions following recovery from facial trauma, previous TMJ surgery, arthritis or infection should make the clinician suspicious of ankylosis.

When conditions of muscle contracture, capsular fibrosis or ankylosis exist, the restriction of movement is not reversed by induction of anaesthesia. These patients are best managed by fibreoptic intubation or one of the alternative methods described below.

Trauma

Bony fragments from a fractured zygoma may impinge onto the coronoid process blocking condylar translation. Rarely, after violent trauma, the condyle may be displaced into the middle cranial fossa. In both these circumstances it may be impossible to open the mouth.

Disease causing soft tissue rigidity

The degree of restriction to mouth opening can be accurately assessed by physical palpation of the involved soft tissues.

Airway management

In patients with TMJ abnormalities the airway management problem should be explained to the patient. The proposed treatment plan should be explained and informed consent obtained.

Patients without fixed restriction to mouth opening

This will include the majority of patients who have muscle disorders, disc condyle disorders, joint inflammation or hypermobility. Mouth opening is restricted by pain but the restriction will be overcome by the induction of general

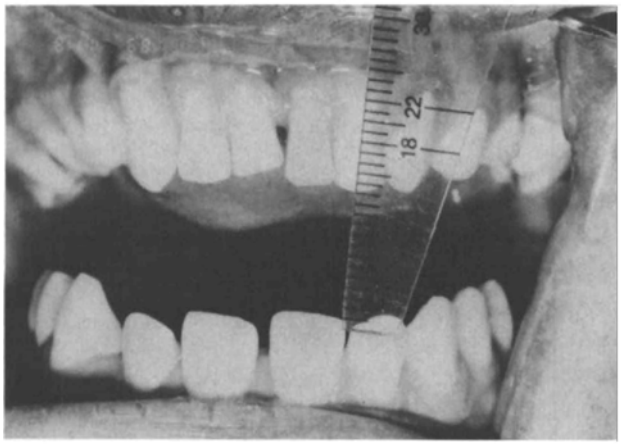

FIGURE 9.

anaesthesia. Normal procedures can be followed during direct laryngoscopy and other airway manoeuvres such as jaw thrust. It should be remembered that tissue injury is present and the mouth should not be opened further than necessary. Jaw manipulation should be firm but not forceful.

Surgical patients with restricted mouth opening

If feasible a regional analgesic technique should be chosen for the surgical procedure and manipulation of the upper airway should be avoided. For longer procedures the use of a laryngeal mask should be considered if the incisal opening is sufficient to permit its introduction. If complications occur requiring intubation this may not be possible. Thus, if tracheal intubation is desired and mouth opening is marginally sufficient for laryngoscopy, the use of a special instrument such as the Bellscope[3] or Bullard laryngoscope[4] should be considered. If the mouth opens less than 25 mm it is unlikely that any part of the larynx will be visualized by direct laryngoscopy. The patient's upper airway should receive topical local anaesthetic spray and gargle. Transoral or transnasal fibreoptic bronchoscopy assisted intubation should be performed under sedation or inhalation general anaesthesia, with the patient breathing spontaneously.

This method was used on a planned basis to intubate the trachea of a 22-yr-old male transnasally (Figure 9) who required right TMJ arthroplasty for ankylosis. Facial fractures two years previously had required eight weeks of maxillomandibular fixation. His maximal incisal gap was only 12 mm.

Alternatives to fibreoptic intubation have been described. In the topicalized sedated patient, blind nasotracheal intubation can be attempted. A method using a retrograde catheter or wire passed upwards through the cricothyroid membrane can be used as a guide to introducing the endotracheal tube.[5]

Critical care patients with restricted mouth opening

ACUTE UPPER AIRWAY OBSTRUCTION

Severe facial trauma, deep space infection, large tumours or gross anatomical distortion can all lead to a severe compromise in the patency of the upper airway. With the added problems of airway bleeding, exudate and oedema there is a risk that any manipulation in the upper airway could precipitate complete airway obstruction without the means of airway control. In such cases it is safer to perform tracheostomy or cricothyrotomy under local infiltration in the awake patient. Oxygen should be given by mask and a dedicated observer should monitor oxygen saturation with a pulse oximeter while the procedure is being done.

ACUTE VENTILATORY INSUFFICIENCY

Elective tracheostomy or cricothyrotomy is appropriate for a patient who has restricted mouth opening with relatively normal upper airway but severe acute ventilatory insufficiency. This could result from extensive lung trauma, pneumonia, pulmonary oedema or ARDS. Such patients might not be able to tolerate periods of breath holding that accompany manipulation in the upper airway without becoming severely hypoxaemic.

Conclusion

Patients with a TMJ mobility problem need careful assessment. Specialized techniques and manoeuvres may be needed to gain control of his/her upper airway safely and effectively. The presence of upper airway obstruction or ventilatory insufficiency adds to the risk of management. Patient with a history or signs of TMJ disorder should be referred to an oral surgeon or dentist for further evaluation and treatment.

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