



## A Review of Intubation Techniques in Anaesthetic Management of Temporomandibular Joint Ankylosis

Archna Sharma<sup>1</sup>, Manish Kumar Sharma<sup>2\*</sup>

<sup>1</sup>Resident, Department of Anaesthesia, IGMC, Shimla, Himachal Pradesh, India.

Email: drarchanasharma1991@gmail.com

Orcid ID: 0000-0002-6860-4009

<sup>2</sup>Resident, Department of Oral & Maxillofacial surgery, HPGDC, Shimla, Himachal Pradesh, India. Email: manishsharmamfos@gmail.com, Orcid ID: 0000 0002 1722 3118.

\*Corresponding author

Received: 16 October 2021

Revised: 02 November 2021

Accepted: 11 November 2021

Published: 22 December 2021

### Abstract

Intubation of a patient with temporomandibular joint ankylosis is a challenge for every anaesthesiologist. Dependable anaesthetic technique is most desired by all anaesthesiologists. The purpose of the present article is to have a brief overview of temporomandibular joint ankylosis, its clinical features, management and to review literature demonstrating various intubation techniques available to an anaesthesiologist while managing patients with temporomandibular joint ankylosis.

**Keywords:-** Intubation technique, Temporomandibular joint ankylosis, Fiberoptic intubation, Blind nasal intubation, Retrograde intubation, Light wand aided intubation.

### INTRODUCTION

Intubation of temporomandibular joint (TMJ) ankylosis patient with limited mouth opening is one of the most challenging situation faced by an anaesthesiologist.<sup>[1]</sup> TMJ ankylosis patients have limited or nil mouth opening making intubation by direct laryngoscopy impossible as there is no direct visualization of vocal cords.<sup>[2]</sup> As TMJ ankylosis presents with diverse anatomical hurdles, a thorough meticulous pre operative anaesthetic plan is of paramount importance in view of anticipated difficult airway. Concerning anaesthesiologist should have due expertise and ability to deal with any unexpected difficulties.<sup>[1]</sup> Dependable anaesthetic intubation techniques are most desired by anaesthetists in managing such difficult airway situations.<sup>[2]</sup> Use of techniques

like orotracheal intubation, laryngeal mask airway, combitube and cuffed oropharyngeal airway is not possible due to limited mouth opening. Altered airway anatomy in TMJ ankylosis patients presenting late in adolescence or adulthood makes the use of conventional methods of intubation impossible. A blind nasal intubation, fibre optic intubation, fluoroscope-aided retrograde placement of guide wire for tracheal intubation, retrograde endotracheal intubation using a pharyngeal loop, semi blind technique of nasal intubation and tracheostomy are the possible methods available in such cases. However awake fiberoptic intubation is considered as the gold standard.<sup>[3]</sup>



## **Etiopathogenesis of temporomandibular joint ankylosis**

TMJ ankylosis can be intra-articular or extra-articular based on location, or bony, fibrous, or fibro-osseous based on type of tissue involved and complete, or incomplete based on extent of fusion. Trauma is the most common cause of TMJ ankylosis followed by local infection or systemic infection. Systemic autoimmune diseases like ankylosing spondylitis, psoriasis and juvenile rheumatoid arthritis may also cause TMJ ankylosis. Previous TMJ surgery, congenital deformities, idiopathic factors, iatrogenic causes, use of forceps for delivery, neoplasm, radiotherapy and prolonged immobilization are the other causes of TMJ ankylosis. Post traumatic hematoma in TMJ region gets organized by fibrosis and calcification followed by obliteration of the joint space or juxta-articular bone formation resulting in consolidation and immobility of the joint.<sup>[4,5,6,7,8]</sup>

## **Clinical features and radiological evaluation**

Patients classically present with bird face deformity having convex facial profile, steep occlusal plane, hypoplastic and retrognathic mandible. Patients usually have restricted mouth opening, malocclusion, poor oral hygiene, dental caries, difficulty in mastication, malnutrition and impaired speech. Severity of symptoms is increased in case of bilateral TMJ involvement. Narrowing of the oropharyngeal airway occur secondary to shortening of the mandibular rami with narrowing of the space between the mandibular angles. Some patients present with obstructive sleep apnoea. Orthopantomogram gives a two-dimensional view of maxilla and mandible. It is relatively a

less expensive diagnostic aid. Computerized tomographic scans provide coronal, axial and sagittal sections as well as three-dimensional view of the mandible and skull for thorough pre and post operative radiographic evaluation.<sup>[5,6,7,8]</sup>

## **Management**

TMJ ankylosis patient management involves aggressive excision of the fibrous or bony ankylotic mass, coronoidectomy on the affected side, coronoidectomy of the contralateral side in case maximal incisal opening achieved is less than 35 mm, lining of TMJ with temporalis myofascial flap or with native disc, reconstruction of the ramus condyle unit with either distraction osteogenesis or costochondral / sternoclavicular / iliac crest graft and rigid fixation followed by early mobilization of the jaw. In some patients lateral arthroplasty, vertical ramus osteotomy or alloplast are also used in temporomandibular joint reconstruction. All these surgical procedures are performed under general anaesthesia which is a challenging task for the anaesthesiologist.<sup>[6]</sup>

## **LITERATURE REVIEW**

Vas and Sawant in the year 2001 presented an anaesthetic technique and reviewed it on 15 paediatric patients with temporomandibular (TMJ) ankylosis. This technique used local blocks for nerves of larynx and topical anaesthesia for upper airway. Combination of halothane and ether was given by spontaneous ventilation using bilateral nasopharyngeal airways. Tongue depressor or tip of laryngoscope was used with fiberoptic light

source in the buccal sulcus to visualize tracheal tube in the pharynx. Nasal forceps, with a smaller tip and narrower blade than Magill forceps was used to guide the tracheal tube towards the air bubbles coming out of larynx.<sup>[2]</sup> Erdem and Alkan in the same year presented a retrospective study on 47 patients with TMJ ankylosis managed by using acrylic marbles in interpositional arthroplasty. Nasotracheal intubation was performed in 33 patients for general anaesthesia while in remaining 14 patients light anesthesia with halothane inhalation, followed by speedy resection of the ankylotic mass was done. Orotracheal intubation was performed once the inter-incisal opening was adequate.<sup>[10]</sup>

Shah et al in the year 2002 presented a case of four and half year old child with a recurrent bilateral TMJ ankylosis and sleep apnoea. Authors suggested special anaesthetic considerations regarding difficulty in intubation, high sensitivity to all central depressant drugs, awake extubation, and post-operative maintenance of a clear airway.<sup>[11]</sup> Kawasaki et al in the same year reported a case of temporomandibular ankylosis in a child secondary to otitis media in which airway management was done using fiberoptic bronchoscope.<sup>[12]</sup> Arya et al in the same year described the role of pharyngeal loop while performing retrograde intubation with epidural catheter in a 30 year old patient with bilateral TMJ ankylosis.<sup>[13]</sup>

Kundra et al in the year 2006 reported two cases of paediatric temporomandibular joint ankylosis in which successful video assisted fiberoptic intubation was done. An adult flexible fiberoptic laryngoscope with a video camera system was used to visualize the glottis

from one nostril while the tracheal tube was passed from the other nostril.<sup>[14]</sup> Dhulkhed in the year 2008 presented a case of retrograde intubation in a 20 year old TMJ ankylosis patient using double guide wire technique in which one flexible J- tipped guide wire was passed into the airway from cricothyroid puncture site and another flexible J- tipped wire was passed from subcricoid site. Both were brought out through the nose. The first guide wire was used for retracting the epiglottis and the second was used as a guide for passing the endotracheal tube.<sup>[15]</sup> Jain et al in the same year presented a retrospective study on 44 patients with TMJ ankylosis. Blind nasotracheal intubation was performed in six patients. In 36 patients, blind intubation of the pharynx followed by release of ankylosis and then nasotracheal intubation through intra oral visualization was done. Fiberoptic technique was used in two patients in whom attempts at blind nasotracheal intubation had failed.<sup>[16]</sup>

Grider et al in the year 2009 reported the use of the Aintree intubating catheter for nasal fiberoptic intubation in a patient with temporomandibular joint ankylosis.<sup>[17]</sup> Dhasmana et al in the year 2010 presented a prospective randomized double blind study on 80 TMJ ankylosis patients who underwent awake blind nasotracheal intubation and concluded that midazolam 0.05mg/kg plus fentanyl 3 microg/kg in bolus provide better comfort and sedation to the patient during the procedure.<sup>[18]</sup> Varughese et al in the year 2011 reported 5 cases in which fluoroscopic assisted airway intubation was performed successfully while managing TMJ ankylosis.<sup>[19]</sup>

Gupta et al in the year 2012 presented a prospective study on 46 patients with TMJ

ankylosis and concluded that fiberoptic intubation was found to be easier with dexmedetomidine premedication along with sedative infusion of propofol with complete amnesia of the procedure, hemodynamic stability and preservation of patent airway.<sup>[20]</sup> K Mohan et al in the same year reported a case of 12 year old male with unilateral TMJ ankylosis. Condylectomy was done under total intravenous anaesthesia (TIVA) with spontaneous breathing followed by endotracheal intubation with direct laryngoscopy.<sup>[21]</sup> Moon and Chon in the year 2012 reported a case of TMJ ankylosis in 72 year old male patient, done under local anaesthesia combined with monitored anaesthesia care (MAC).<sup>[22]</sup> Kang et al in the year 2013 reported a case of airway management using fiberoptic bronchoscope in a patient with TMJ ankylosis and ankylosing spondylitis.<sup>[23]</sup>

Gupta et al in the year 2015 reported the use of videolaryngoscope assisted fiberoptic intubation in a 6 year old male patient with bilateral TMJ ankylosis.<sup>[24]</sup> Sankar et al in the year 2016 retrospectively evaluated 48 patients having temporomandibular joint ankylosis. 92% patients successfully underwent blind awake intubation, 6% had fiberoptic awake intubation and 2% required surgical airway. Authors suggested blind awake intubation as an alternative in case fiberoptic intubation is not available.<sup>[3]</sup> Goswami et al in the same year presented a review on the surgical and anaesthetic challenges in the management of young patients with temporomandibular joint ankylosis.<sup>[23]</sup>

Jain et al in the year 2019 presented a case of 10 year old girl with bilateral TMJ ankylosis,

hypoplastic mandible and adenoid hypertrophy. In this case suction catheter assembly was used to negotiate the endotracheal tube across the adenoid where the endotracheal tube (ET) was introduced through one nostril and an unmatched-size flexible intubation fiberscope (FIF) was introduced through other nostril and the intubation of the ET tube was done under direct endoscopic view of FIF through external laryngeal manipulation under conscious sedation.<sup>[1]</sup> Vitkovik et al in 2020 presented a case of 8 year old male child with temporomandibular joint ankylosis. Authors managed the case with rigid fiberoptic intubation using a 5mm diameter Bonfils retromolar intubation fiberscope and suggested it to be an alternative method in difficult airway management in paediatric patients.<sup>[26]</sup>

### **Anaesthetic management**

Intubation in patients with temporomandibular joint ankylosis can be difficult because of their limited mouth opening. Also, there will be no scope of jaw thrust or chin lift in propensity of an airway collapse. Techniques which can be used are blind nasal intubation, fiberoptic optic intubation, retrograde intubation technique, lightwand aided intubation and surgical airways. These intubation techniques can be performed either under deep sedation or general anesthesia with or without relaxation or can be performed while awake using regional blocks or topical anaesthesia. Sedation in these patients can aggravate airway obstruction by reducing the pharyngeal muscle tone and should be cautiously used. It is mostly required in children and in non





cooperative patients where awake intubation is not possible. It is extremely important to remember that awake intubation under topical or regional nerve blocks using mild sedation along with drying agent is the safest technique.<sup>[25]</sup>

## Overview of intubation techniques used in TMJ ankylosis management.

### Fibreoptic Intubation

In this technique, intubation is done with the help of fibreoptic bronchoscope. Awake fibreoptic intubation is the gold standard for difficult airway. Awake fibreoptic intubation is an elective procedure which should be done with proper preoperative preparation rather than as the last ditch effort to secure difficult airway. It also facilitates suction and oxygen supplementation during the procedure. The technique has few shortcomings like persistent manipulation of the fibreoptic bronchoscope can result in bleeding and poor patient cooperation when attempted awake. Blood and secretions can obliterate the field of vision and reduce the chance of successful intubation. It is expensive and different sizes of bronchoscope are required for smaller endotracheal tubes. This technique has significant learning curve.<sup>[20,26]</sup>

### Blind nasal intubation

In case of unavailability of expensive instruments, blind awake intubation is an effective alternative technique in difficult airway situation like TMJ ankylosis. It is less expensive procedure with less chances of induction of trauma. However thorough expertise and meticulous planning is required to perform the procedure. As the procedure

being blind repeated attempts can cause middle or inferior turbinate injury, infection, nasal mucosal injury and epistaxis.<sup>[18,27]</sup>

### Retrograde intubation technique

Retrograde intubation was first described by Butler in the year 1960.<sup>[28]</sup> Various modifications were described over the years.<sup>[13,29]</sup> Classically in retrograde intubation technique, a guide wire or catheter is passed through cricothyroid membrane and brought out through mouth. Another catheter is passed through nose and brought out through mouth. Then the two catheters are tied to be used as guide for intubation. This technique cannot be used in patients with limited mouth opening. Arya et al suggested the use of pharyngeal loop passed through nose to retrieve the catheter in the pharynx passed through cricothyroid membrane.<sup>[13]</sup> Bhattacharya et al retrieved the retrograde catheter using suction in patients with limited mouth opening.<sup>[30]</sup> Biswas et al reported the use of fluoroscope aided retrograde placement of guide wire for tracheal intubation in patients with limited mouth opening.<sup>[31]</sup>

Dhulkhed suggested the double guide wire technique for retrograde intubation in TMJ ankylosis patients. In this technique, a flexible J- tipped wire is inserted retrogradely through the cricothyroid membrane using a 16 gauze cannula and is advanced upwards under fluoroscopic guidance. The endotracheal tube is then passed over the guide wire and secured. While using this technique it is observed that the endotracheal tube is often obstructed by the epiglottis. So, second guide wire is passed through subcricoid puncture and is used to hold back the epiglottis while

the endotracheal tube is passed over the other guide wire.<sup>[15]</sup>

### Light wand aided intubation

Light wand guided intubation is based on the principle of illumination. On placing the tip of the lightwand inside the glottis, a bright light glow can be seen easily in the soft tissue of the anterior neck. In case lightwand is placed in the esophagus, no transillumination can be observed. Since its introduction in the year 1956, several modifications of the Light wand device were available. One such modification was Trachlight which became available in the year 1995. Trachlight consist of a handle, a wand and a stylet. Nasal intubation can also be performed with this device. It is relatively inexpensive technique which requires less expertise. It is less traumatic than blind nasal intubation and presence of blood and secretion is of less consequence than that in fiberoptic intubation.

Ability to see the glow is less in obese patients while in frail patients some trans illumination may occur even if the tube tip is placed in the oesophagus. It provides no visualization of the pharyngeal and laryngeal structures. The

technique is contraindicated if there are tumours, infection, trauma or foreign body in the upper airway. Obesity, short neck, limited neck extension and un-cooperative patients are relative contra indications. Recently a Trachway device with video intubating stylet for tracheal intubation has been introduced for use in patients with limited mouth opening.<sup>[32,33,34,35]</sup>

### Surgical airways

Surgical airways like tracheostomy and cricothyrotomy can be used. There are two types of tracheostomy, surgical (conventional) tracheostomy and percutaneous dilatational tracheostomy. These techniques are invasive and are associated with significant morbidity.<sup>[8,16]</sup>

## CONCLUSIONS

Awake fiberoptic intubation is the gold standard for difficult airway. Blind nasal intubation is an effective alternative in the hands of an expert anaesthesiologist in case of unavailability of fiber optic bronchoscope. Retrograde intubation technique and use of light wand aided intubation technique are also seem to be promising alternatives.

## REFERENCES

1. Jain G, Barik AK, Banerjee A, S N, Chug A. Airway challenges in bilateral temporomandibular joint ankylosis with adenoid hypertrophy: a case report. *J Oral Biol Craniofac Res.* 2019;9(3):256-258. doi:10.1016/j.jobcr.2019.06.008
2. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al; American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. *Anesthesiology.* 2013;118(2):251-70. doi: 10.1097/ALN.0b013e31827773b2.
3. Sankar D, Krishnan R, Veerabahu M, Vikraman BP, Nathan JA. Retrospective evaluation of airway management with blind awake intubation in temporomandibular joint ankylosis patients: A review of 48 cases. *Ann Maxillofac Surg.* 2016;6(1):54-57. doi:10.4103/2231-0746.186126
4. Sporniak-Tutak K, Janiszewska-Olszowska J, Kowalczyk R. Management of temporomandibular



- ankylosis--compromise or individualization--a literature review. *Med Sci Monit.* 2011;17(5):RA111-RA116. doi:10.12659/msm.881755
5. He D, Ellis E 3rd, Zhang Y. Etiology of temporomandibular joint ankylosis secondary to condylar fractures: the role of concomitant mandibular fractures. *J Oral Maxillofac Surg.* 2008;66(1):77-84. doi: 10.1016/j.joms.2007.08.013.
  6. Kaban LB, Bouchard C, Troulis MJ. A protocol for management of temporomandibular joint ankylosis in children. *J Oral Maxillofac Surg.* 2009;67(9):1966-78. doi: 10.1016/j.joms.2009.03.071.
  7. Arakeri G, Kusanale A, Zaki GA, Brennan PA. Pathogenesis of post-traumatic ankylosis of the temporomandibular joint: a critical review. *Br J Oral Maxillofac Surg.* 2012;50(1):8-12. doi: 10.1016/j.bjoms.2010.09.012.
  8. Movahed R, Mercuri LG. Management of temporomandibular joint ankylosis. *Oral Maxillofac Surg Clin North Am.* 2015;27(1):27-35. doi: 10.1016/j.coms.2014.09.003.
  9. Vas L, Sawant P. A review of anaesthetic technique in 15 paediatric patients with temporomandibular joint ankylosis. *Paediatr Anaesth.* 2001;11(2):237-44. doi: 10.1046/j.1460-9592.2001.00608.x.
  10. Erdem E, Alkan A. The use of acrylic marbles for interposition arthroplasty in the treatment of temporomandibular joint ankylosis: follow-up of 47 cases. *Int J Oral Maxillofac Surg.* 2001;30(1):32-6. doi: 10.1054/ijom.2000.0006.
  11. Shah FR, Sharma KR, Hilloowalla RN, Karandikar AD. Anaesthetic considerations of temporomandibular joint ankylosis with obstructive sleep apnoea: a case report. *J Indian Soc Pedod Prev Dent.* 2002;20(1):16-20.
  12. Kawasaki T, Sata T, Kawasaki C, Ogata M, Shigematsu A. Airway management of a child with temporomandibular joint ankylosis following otitis media. *Anaesthesia.* 2002;57(3):294-5. doi: 10.1111/j.1365-2044.2002.2520\_19.x.
  13. Arya VK, Dutta A, Chari P, Sharma RK. Difficult retrograde endotracheal intubation: the utility of a pharyngeal loop. *Anesth Analg.* 2002 Feb;94(2):470-3. doi: 10.1097/0000539-200202000-00046.
  14. Kundra P, Vasudevan A, Ravishankar M. Video assisted fiberoptic intubation for temporomandibular ankylosis. *Paediatr Anaesth.* 2006;16(4):458-61. doi: 10.1111/j.1460-9592.2005.01730.x.
  15. Raval C, Patel H, Patel P, Kharod U. Retrograde intubation in a case of ankylosing spondylitis posted for correction of deformity of spine. *Saudi J Anaesth.* 2010;4(1):38-41. doi:10.4103/1658-354X.62616
  16. Jain G, Kumar S, Rana AS, Bansal V, Sharma P, Vikram A. Temporomandibular joint ankylosis: a review of 44 cases. *Oral Maxillofac Surg.* 2008;12(2):61-6. doi: 10.1007/s10006-008-0103-y.
  17. Grider JS, Van Sickels JE, Lock RL. Novel use of the Aintree intubating catheter for nasal fiberoptic intubation in a patient with temporo-mandibular ankylosis. *J Clin Anesth.* 2009;21(2):151-2. doi: 10.1016/j.jclinane.2008.08.012.
  18. Dhasmana S, Singh V, Pal US. Awake Blind Nasotracheal Intubation in Temporomandibular Joint Ankylosis Patients under Conscious Sedation Using Fentanyl and Midazolam. *J Maxillofac Oral Surg.* 2010;9(4):377-381. doi:10.1007/s12663-010-0159-8
  19. Varughese I, Varughese PI, Soman T, Mathew J. Fluoroscopic assisted airway intubation in temporomandibular joint ankylosis: a novel technique. *Saudi J Anaesth.* 2011; 5(2):226-228.
  20. Gupta K, Jain M, Gupta PK, Rastogi B, Saxena SK, Manngo A. Dexmedetomidine premedication for fiberoptic intubation in patients of temporomandibular joint ankylosis: A randomized clinical trial. *Saudi J Anaesth.* 2012;6(3):219-23. doi: 10.4103/1658-354X.101211.
  21. K M, Rupa L M, Krishna Murthy S G, P G G, U B. Anaesthesia for TMJ Ankylosis with the Use of TIVA, Followed by Endotracheal Intubation. *J Clin Diagn Res.* 2012;6(10):1765-1767. doi:10.7860/JCDR/2012/3947.2605
  22. Moon HS, Chon JY. Anesthetic implications for operative management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg.* 2012;70(7):1505. doi: 10.1016/j.joms.2012.04.018.
  23. Kang JM, Lee KW, Kim DO, Yi JW. Airway management of an ankylosing spondylitis patient with severe temporomandibular joint ankylosis and impossible mouth opening. *Korean J Anesthesiol.* 2013;64(1):84-86. doi:10.4097/kjae.2013.64.1.84
  24. Gupta A, Kapoor D, Awana M, Lehl G. Fiberscope Assisted Videolaryngoscope Intubation in the



- Surgical Treatment of TMJ Ankylosis. *J Maxillofac Oral Surg.* 2015;14(2):484-486. doi:10.1007/s12663-014-0619-7
25. Goswami D, Singh S, Bhutiya O, Baidya D, Sawhney C. Management of young patients with temporomandibular joint ankylosis -a surgical and anesthetic challenge. *Indian J Surg.*2016; 78(6):482-89.
26. Vitkovic B, Milic M, Filipan D, Dediol E. Rigid Fiber-Optic Device Intubation in a Child with Temporomandibular Joint Ankylosis. *J Craniofac Surg.* 2020;31: e193-e194.
27. Shrikant GL, Kedareshwar GP, Pramod BP et al. Anaesthetic management of temporomandibular joint ankylosis in paediatric patient. *Int J Health Sci Res.* 2015; 5(12):433-436.
28. Butler F S, Cirillo A A. Retrograde tracheal intubation. *Anesth Analg.* 1960; 39: 333-338.
29. Powel W F, Ozdilt. A translaryngeal guide for tracheal intubation. *Anesth Analg* 1967;46: 231-234.
30. Bhattacharya P, Biswas BK, Baniwal S. Retrieval of a retrograde catheter using suction, in patients who cannot open their mouths. *Br J Anaesth* 2004; 92:888-90.
31. Biswas B K, Bhattacharya P, Joshi S, Tuladhar U R, Baniwal S. Fluoroscope aided retrograde placement of guide wire for tracheal intubation in patients with limited mouth opening. *Br J Anaesth* 2005;94:128-131.
32. Agro F, Hung OR, Cataldo R, Carassiti M, Gherardi S. Lightwand intubation using the Trachlight: a brief review of current knowledge. *Canadian Journal of Anaesthesia* 2001; 48: 592-9.
33. Favaro R, Tordiglione P, Di Lascio F, et al. Effective nasotracheal intubation using a modified transillumination technique. *Canadian Journal of Anaesthesia* 2002; 49: 91-5.
34. Cheng KI, Chang MC, Lai TW, et al. A modified lightwand guided nasotracheal intubation technique for oromaxillofacial surgical patients. *Journal of Clinical Anesthesia* 2009; 21:258-63.
35. Lee M, Tseng K, Shen Y, Lin C, Hsu C, Hsu H et al. Nasotracheal intubation in patients with limited mouth opening: a comparison between fiberoptic intubation and the Trachway®. *Anaesthesia.* 2015;71(1):31-38.

Source of Support: Nil, Conflict of Interest: None declared