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Clinical Paper
TMJ Disorders

New protocol to prevent TMJ reankylosis and potentially life threatening complications in triad patients

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Abstract. The management of patients with the triad of temporomandibular joint (TMJ) ankylosis, micrognathia and obstructive sleep apnea syndrome is challenging for the oral and maxillofacial surgeon because it involves achieving the desired oral opening, correction of micrognathia, and correction of the obstructed airway. Seven of the authors' triad patients, in whom only the release of ankylosis was performed, developed bradycardia and respiratory distress during postoperative jaw physiotherapy, leading to their non-compliance for active jaw physiotherapy and subsequent reankylosis. This paper suggests a new surgical protocol for the management of patients with the triad, to achieve correction of the obstructed airway, relief of the respiratory distress symptoms, correction of micrognathia and restricted mouth opening. It also provides a logical reason for the occurrence of bradycardia following ankylosis release and its potential role in TMJ reankylosis. It emphasizes that the occurrence of bradycardia in triad patients during jaw exercises is dictated by the severity of their apnea–hypopnea index and the degree of narrowing of their posterior airway space. The recognition and prevention of this by the new protocol is discussed in 7 patients.

Keywords: TMJ ankylosis; OSAS; micrognathia; bradycardia; trigemino-cardiac reflex.

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Temporomandibular joint (TMJ) ankylosis causes restricted mouth opening and affects the growth and development of the mandible in growing patients. The reduced size of the mandible and its retruded position causes retro-displacement of the tongue and concomitant reduction of the oropharyngeal airway which can lead to upper airway obstruction and induce obstructive sleep apnea syndrome (OSAS).[1]

The triad of TMJ ankylosis, micrognathia and OSAS is often seen in growing children and adolescents when ankylosis affects the growth pattern. The treatment of this triad ideally should be directed towards the release of ankylosis and mandibular advancement to enlarge the collapsed posterior airway space (PAS) and relieve OSAS.

Most treatment protocols are designed mainly to treat the ankylosis, and the management of OSAS is often secondary. Owing to the obvious disadvantages of simultaneous distraction and ankylosis release,[2] this method was not used in the present patients with the triad. The authors initially followed a two stage protocol, where ankylosis was released first and mandibular distraction for advancement was performed in the second stage. Following the release of ankylosis, during postoperative jaw physiotherapy, it was

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noted that beyond a certain point of jaw-stretching exercise, patients developed respiratory distress, bradycardia and a drop in oxygen saturation which led to their non-compliance for active jaw-stretching exercises. This non-compliance led to reankylosis and reduced oral opening within less than a year. The authors suggest a new surgical protocol for the management of patients with the triad. They also emphasize the relationship between the severity of the apnea–hypopnea index (AHI) and degree of narrowing of the PAS with the postoperative occurrence of bradycardia in triad patients and suggest that the latter could be a possible etiologic factor for reankylosis. This paper describes the occurrence of bradycardia via the trigemino-cardiac reflex (TCR); a potentially life threatening reflex.[3] The term trigemino-cardiac reflex was coined by two anaesthetists, Shelly and Church, in 1988.[4] It was previously termed an oculo-cardiac reflex by Aschner and Dagnini in 1908 as it was noted only during ocular surgeries due to the stimulation of V1.[5,6] An attempt is made here to provide a logical explanation for this reflex and suggest ways of preventing it, based on the authors' experience, a review of the literature and a new protocol.

Patients and methods

15 patients with the triad were seen in the authors' department during 2002–2005. All underwent a thorough history and clinical examination. The patients gave a history of snoring and a disturbed sleep pattern with no abnormal ECG findings, cardiac problems or any other relevant medical history. Their baseline heart rate ranged from 72 to 80 beats/min. Their interincisal opening ranged from 0 to 1.5 cm. Their clinical examination revealed mandibular retrognathia of varying degrees and absent/minimal (bilateral or unilateral ankylosis) TMJ movements, hence a clinical diagnosis of the triad of TMJ ankylosis, micrognathia and OSAS was established in them. This was confirmed by polysomnographic studies. Based on their polysomnographic studies and lateral cephalogram assessment, they were categorized as having mild (PAS $\geq$ 8 mm, AHI 5–15), moderate (PAS 5–7 mm, AHI 15–30), or severe (PAS $\leq$ 4 mm, AHI $>$ 30) values. Of these 15 triad patients, 8 patients had mild to moderate values (patients 1–8, Table 1), and 7 (numbers 9–15, Table 1) had severe values with an average AHI of 46.6 and other positive variables. Of these 7 patients (5 males, 2 females), 4 were children ($<$12 years) and 3 were adolescents (13–17 years). Of the 4 children, one had unilateral ankylosis and 3 had bilateral ankylosis. Of the 3 adolescents, two had unilateral and one had bilateral ankylosis.

Initial protocol

All 15 patients underwent the initial protocol, but only 8 were successful and the others re-ankylosed. Of the 7 severe triad cases, 6 patients (4 children and 2 adolescents) underwent surgery for ankylosis release with gap arthroplasty and interposition with temporalis myofascial flap with coronoidectomy (unilateral or bilateral when deemed necessary) under general anaesthesia.

One adolescent patient, who had undergone surgery at another tertiary centre, presented with restricted mouth opening. The previous surgical records and radiographs for this patient revealed that a similar procedure had been performed for ankylosis release except coronoidectomy. Her restricted mouth opening was due to the intact coronoids and temporalis muscle pull, therefore bilateral coronoidectomy was performed under general anaesthesia. All the 7 patients were to undergo mandibular distraction as a second stage procedure following 4–6 months of ankylosis release when adequate mouth opening was well established.

Following TMJ ankylosis release in these 7 severe triad patients, it was observed that during postoperative jaw physiotherapy, beyond a certain point (i.e. after an average of 2–2.5 cm of inter-incisal opening) the patients became restless and developed a choking sensation, respiratory distress, bradycardia and a drop in oxygen saturation, which was confirmed on pulse oximeter. These symptoms were so severe that they led to non-compliance for active jaw physiotherapy postoperatively. This finding was not seen in all the patients intra-operatively when the mouth was opened beyond 4 cm after ankylosis release. These symptoms disappeared on removal of the jaw stretcher and recurred each time mouth opening was attempted beyond that certain point for that particular patient.

To investigate the reason for this discomfort, a quick lateral cephalogram was taken with the jaw stretcher in situ and it was observed that the PAS was practically obliterated (Fig. 1). All these 7 patients

Table 1. Patient details.

Sr. no.	Age (years)	Gender	TMJ affected	PAS (mm)[a]	AHI	Triad severity	Preoperative mouth opening (mm)	Postoperative mouth opening (mm) (5 year follow-up)
1	8	M	UL	8	10	M	6	33[b]
2	10	F	UL	8	13	M	5	34[b]
3	13	F	BL	9	7	M	2	32[b]
4	18	M	UL	10	9	M	9	30[b]
5	6	M	UL	5	20	MOD	7	31[b]
6	9	F	BL	5	25	MOD	3	34[b]
7	12	M	BL	6	28	MOD	4	32[b]
8	16	M	UL	7	22	MOD	9	33[b]
9	7	M	BL	3	47	S	3	Lost to follow-up
10	8	M	BL	4	46.5	S	7	38[c]
11	9	F	BL	4	46	S	4	37[c]
12	10	M	UL	4	47.6	S	3	36[c]
13	14	M	UL	4	46.4	S	7	38[c]
14	16	F	UL	4	46.9	S	7	39[c]
15	17	M	BL	4	46.5	S	8	40[c]

UL, unilateral ankylosis; BL, bilateral ankylosis. Triad severity: M, mild; MOD, moderate; S, severe.
[a] As measured on the lateral cephalogram.
[b] Treated with old protocol.
[c] Treated with new protocol.

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