Original article

UPDCJ OPEN ACCESS

Treatment Options of Temporomandibular Joint Ankylosis at a Tertiary Level Hospital in Bangladesh: A Two-Year Retrospective Analysis

Rahman AFMS [1*], Hosen MI [2], Towhid SJ [3], Talukder MAH [4], Hasan MI [5], Shah MSH [6], Hosain MA [7]

AFFILIATION:

1. **Dr. A.F.M. Shakilur Rahman**, BDS, FCPS (OMS)
   Lecturer, Department of Oral and Maxillofacial Surgery
   Rajshahi Medical College Dental Unit, Rajshahi
2. **Dr. MD. Ikbal Hosen** , BDS, FCPS (OMS)
   Junior Consultant, Department of Oral and Maxillofacial Surgery,
   Chattogram Medical College Dental Unit, Chattogram
3. **Dr. Soroar Jahan Towhid** , BDS, FCPS (OMS)
   Dental Surgeon, Department of Oral and Maxillofacial Surgery,
   Dhaka Dental College and Hospital, Dhaka
4. **Dr. Md. Ali Hossain Talukder** , BDS, FCPS (OMS)
   Junior Consultant, Department Of Oral and Maxillofacial Surgery,
   Shaheed Suhrawardy Medical College Dental Unit, Dhaka
5. **Dr. MD. Imrul Hasan**, BDS, FCPS (OMS)
   Registrar, Department of Oral and Maxillofacial Surgery,
   Dhaka Dental College and Hospital, Dhaka
6. **Dr. MD. Sakawath Hosain Shah**, BDS, MS (OMS)
   Lecturer, Department of Oral and Maxillofacial Surgery,
   Rajshahi Medical College Dental Unit, Rajshahi
7. **Dr. Mohammad Azmal Hossain**, BDS, FCPS (OMS)
   Assistant Professor, Department of Oral and Maxillofacial Surgery,
   Dhaka Dental College and Hospital, Dhaka

Article info.

Received: 21 February 2022
Accepted: 03 May 2022

Volume: Vol-12, Issue-2, October 2022

DOI: https://doi.org/10.3329/updcj.v12i2.58354

Publisher: Update Dental College, Dhaka, Bangladesh
Web: www.updatedentalcollege.edu.bd
E-mail: updcj@hotmail.com

Scan QR code to see the latest issue

*** Corresponding Author**
Dr. A.F.M. Shakilur Rahman, BDS, FCPS (OMS)
Lecturer, Department of Oral and Maxillofacial Surgery
Rajshahi Medical College Dental Unit, Rajshahi, Bangladesh
E-mail: raselblackpearl@gmail.com
https://orcid.org/0000-0001-6995-8434
Phone- +88 01709681040

ABSTRACT:

Introduction: The study compares the surgical treatment options utilized to treat temporomandibular joint ankylosis at a tertiary level hospital in Bangladesh from 2016 to 2017. **Materials and Methods:** In this retrospective analysis, 18 patients (28 joints) were studied. History, radiological and physical examinations, and mouth opening were all part of the preoperative and postoperative evaluation. Age, sex, underlying cause, affected joint (s), surgery modality, complications, and follow-up durations were all taken into consideration. The data was analyzed using the SPSS 22.0 statistical software. The degree of mouth opening before and after different surgical techniques in different patient categories was compared using a one-way ANOVA followed by Tuky's HSD test. **Results:** Temporomandibular joint ankylosis was found to be in several forms (fibrous, fibro-osseous, and osseous), with trauma (61.11%) being the most common cause. The patients ranged in age from 5 to 30 years old, with females accounting for 55.55% of the total. The mean mouth opening significantly increased from 3.11 mm pre-operatively to 31.17 mm in the first month following surgery (p = 0.00001). In 55.55% of the instances, temporary facial nerve paresis occurred. **Conclusions:** Temporomandibular joint ankylosis can be successfully managed with early excision of the ankylotic mass, restoration of the ramus height by bone grafting, interpositional arthroplasty, and intensive physiotherapy.

KEYWORDS : Ankylosis, Arthroplasty, Temporomandibular joint, Treatment

INTRODUCTION:

Temporomandibular joint ankylosis (TMJa) is a condition in which the temporomandibular joint (TMJ) becomes immobile due to the growth of an osseous, fibrous, or fibro-osseous mass attached to the skull base.[1] Speech, mastication, swallowing, gaping, bad oral health, and interference with nutrition and dental therapy are all symptoms of TMJa. There are also difficulties with the limited airway and molar eruption in the mandible. In growing individuals, malocclusion can be associated with deformities of the mandible and maxilla. [2, 3] Sawhney [4] defined four types of TMJa in the pediatric population: type 1 has limited bony fusion but comprehensive fibrous adhesions around the joint; type 2 has more bony fusion, particularly at the outer side of the articular surface, but no fusion within the more medial area of the joint; type 3 has an osseous connection between the mandible and the temporal bone; and type 4 has the joint replaced by a mass of bone. TMJa treatment attempts to restore functional ability while also enhancing the patient's aesthetic look and standard of living. It also aims to prevent re-ankylosis. [5, 6]

To manage pediatric TMJa, Kaban *et al.* [7] recommended a seven-step strategy. It consists of (1) surgical excision of the fibrous and/or osseous ankylotic mass, (2) coronoidectomy on the ankylosed side, (3) coronoidectomy on the unaffected side if the previous two steps do not result in a maximal mouth opening (MMO) greater than 35 mm, (4) employment of a temporalis myofascial flap (TMF) or the native disc for TMJ lining, and (5) reconstruction of the TMJ utilizing distraction osteogenesis (DO) or costochondral graft (CCG), and (6) early

rehabilitation for the TMJ is recommended. If DO is employed to reconstruct the ramus condyle unit, physiotherapy starts on the first postoperative day (POD). If the CCG is utilized to restore the TMJ, the patient undergoes physiotherapy following the 10th POD of maxillomandibular fixation. All patients will receive intensive physiotherapy in the last step (Step 7). The surgical treatments for treating ankylosed condyles can be divided into three categories: condylectomy, gap arthroplasty, and interpositional arthroplasty. In the case of fibrous ankylosis with little distortion of the condylar head, a condylectomy is recommended. Gap arthroplasty is the excision of ankylosed tissue to provide room for joint movement. The placement of an interpositional substance within the joint compartment after excision of the ankylotic mass is referred to as interpositional arthroplasty. Interpositional materials have been documented to be made of both autogenous and alloplastic components.[8] To reconstruct the TMJ, a variety of substances have been employed, such as autogenous, alloplastic, and xenogenic bovine bone grafts. [1, 6, 9, 10]

The focus of this retrospective study is to reflect on the institutional aspects of managing patients with TMJa at a tertiary level hospital in Bangladesh, and to observe if the different surgical techniques utilized between 2016 and 2017 differed in terms of MMO and complications.

MATERIALS AND METHODS:

This clinical retrospective study included 18 TMJa patients (28 joints) who were treated at Dhaka Dental College and Hospital's department of oral and maxillofacial surgery between 2016 and 2017. Because this was a retrospective analysis employing data from departmental medical records, no ethical committee permission was required. Patients had to meet the following criteria to be enrolled in this retrospective analysis: they had to be admitted with true TMJa involving the TMJ; they had to have a pre-operative and postoperative complete data record, which included patient consent, clinical and radiographic examinations; and they had to have finished at least a one-month postoperative follow-up period. Age, sex, underlying cause, affected joint, treatment techniques, and postoperative consequences were all taken into consideration.

A complete patient history, radiological and physical examinations, and mouth-opening assessments were all part of the preoperative evaluation. The extent of mouth opening was measured three times using a millimeter scale (pre-operative, intra-operative, and postoperatively at one month) according to the following formula: maximum mouth opening (MMO) corresponds to maximum inter-incisal distance. In specific cases, orthopantomography (OPG) and computed tomography (CT) were utilized to examine the patients.

A conventional preauricular technique with temporal extension was used to get exposure to the TMJ. The zygomatic arch was reached by following the plane of the superficial temporal fascia inferiorly and anteriorly. The periosteum over the zygomatic arch was incised and reflected, and then the joint capsule was incised vertically. The bulk of the ankylosed joint was revealed and to establish a space of 1.5–2 cm, surgical burs and osteotomes were used to gently excise a portion of bony and/or fibrous tissue between the inferior border of the zygomatic arch and the superior border of the ramus. The masseter and medial pterygoid muscles' tendons were dissected meticulously, and the MMO was measured on a millimeter scale intraoperatively. An additional incision was made 2 cm below the mandibular angle for graft placement and fixation when a bone graft, like CCG, was to be utilized and fastened with wires/screws. When coronoidectomy was required, an intraoral incision was used in indicated cases to provide exposure to the contralateral coronoid processes.

The temporomyofascial muscle flap (TMF) is utilized as a spacer in interpositional arthroplasty. This procedure was mostly employed in adult patients who were at risk of re-ankylosis, such as those with recurrence or significant bone ankylosis. A long myofascial flap was turned outside and downward over the zygomatic arch and put into the glenoid fossa whenever the TMF was utilized as an interposition, and then stitched medially and posteriorly to the neighboring tissues.

Reconstruction arthroplasty is most commonly used in children and adults with severe facial deformities. We used CCG for the reconstruction of the TMJ. In unilateral instances, CCG was obtained from the 5th or 6th rib by a submammary incision. Both the 5th and the 7th ribs were utilized in bilateral cases. Two or three screws were employed to anchor the graft to the ascending ramus of the mandible's external posterior aspect.

When the coronoid process was either a component of the ankylosis or was too long, ipsilateral coronoidectomy was executed employing the same preauricular incision utilized for arthroplasty and MMO was still less than planned (< 35 mm). In cases where the contralateral coronoid was too lengthy to encroach on the posterior aspect of the contralateral maxilla, contralateral coronoidectomy (transoral) was performed.

A vacuum drainage was placed for 48 hours in most cases, as well as all wounds were closed in layers and carefully dressed. To control pain, improve the opening of the jaw, and limit the risk of infection, all patients were given postoperative painkillers and prophylactic antibiotics.

The data was analyzed using the SPSS 22.0 statistical software. The mean and standard deviation for several variables were calculated using descriptive statistics. The degree of mouth opening before and after different surgical techniques in various patient categories was compared using a one-way ANOVA followed by Tuky's HSD test.

RESULTS:

Details of the patient with TMJ ankylosis are presented in Table-I

Table I: Details of patient with TMJ ankylosis

Case no.	Age (years)/ Gender	Aetiology	Involved joint	Type of ankylosis	Pre op MMO (mm)	Intra op MMO (mm)	Post op MMO (1 month) (mm)
1.	10/M	Infection	Unilateral (Rt)	Fibrous	3	33	32
2.	6/F	Trauma	Bilateral	Rt = Osseous Lt = Fibrous	0	32	13
3.	12/M	Trauma	Bilateral	Rt = Osseous Lt = Fibrous	0	32	28
4.	16/F	Infection	Unilateral (Rt)	Osseous	1	32	31
5.	23/M	Trauma	Bilateral	Rt = Osseous Lt = Osseous	0	48	35
6.	26/M	Trauma	Unilateral (Rt)	Osseous	0	40	25
7.	13/F	Typhoid	Unilateral (Lt)	Fibro-osseous	8	52	23
8.	11/F	Trauma	Bilateral	Rt = Fibrous Lt = Osseous	3	45	36
9.	12/M	Trauma	Bilateral	Rt = Fibrous Lt = Fibro-osseous	14	42	38
10.	12/M	Trauma	Bilateral	Rt = Fibrous Lt = Fibro-osseous	8	40	33
11.	30/F	Osteochondroma	Unilateral (Lt)	Osseous	0	40	35
12.	20/F	Trauma	Bilateral	Rt = Osseous Lt = Osseous	0	40	36
13.	5/M	Unknown	Unilateral (Lt)	Osseous	4	35	32
14.	16/F	Infection	Unilateral (Lt)	Osseous	0	43	36
15.	24/F	Trauma	Unilateral (Lt)	Osseous	1	40	40
16.	11/F	Trauma	Bilateral	Rt = Osseous Lt = Osseous	2	35	40
17.	14/M	Trauma	Bilateral	Rt = Osseous Lt = Fibrous	5	35	18
18.	17/F	Unknown	Bilateral	Rt = Fibro-osseous Lt = Fibrous	7	43	30

F, Female; Intraop, Intra-operative; Lt, Left; M, Male; MMO, Maximum mouth opening; mm, Millimetre; Postop, Post-operative; Preop, Pre-operative; Rt, Right.

Table II: Details of treatment modalities with postoperative complications

Case no.	Treatment modalities	Coronoidectomy	TMJ reconstruction/ Interposition	Complications	Additional treatment
1.	Condylectomy (Right)	Bilateral	-	-	-
2.	Gap arthroplasty with TMJR	Bilateral	CCG (Right)	TFNP	-
3.	Gap arthroplasty with TMJR	Left	CCG (Right)	TFNP	-
4.	Interpositional arthroplasty	Right	TMF (Right)	TFNP	Advancement genioplasty
5.	Gap arthroplasty	Bilateral	-	-	-
6.	Interpositional arthroplasty	Bilateral	TMF (Right)	TFNP	-
7.	Interpositional arthroplasty	Bilateral	TMF (Left)	TFNP	-
8.	Interpositional arthroplasty	Bilateral	TMF (Left)	TFNP	-
9.	Gap arthroplasty (Left) Condylectomy (Right)	Bilateral	-	TFNP	-
10.	Condylectomy (Left)	Bilateral	-	-	-

11.	Gap arthroplasty	-	-	-	-
12.	Gap arthroplasty (Bilateral)	Right	-	-	-
13.	Interpositional arthroplasty	Bilateral	TMF (Left)	TFNP	-
14.	Gap arthroplasty	Left	-	-	-
15.	Interpositional arthroplasty	Right	TMF (Left)	TFNP	-
16.	Gap arthroplasty (Bilateral)	Right	-	-	-
17.	Gap arthroplasty (Bilateral)	Left	-	-	-
18.	Interpositional arthroplasty	Bilateral	TMF (Right)	TFNP	-

CCG, Costochondral graft; TMF, Temporalis myofascial flap; TFNP, Temporary facial nerve paresis.

Table III: Statistical analysis for the patient's age, gender, and mouth opening

	Age (years)			**Mean MMO (mm)**		
	Male	Female	Total	Pre-op.	Intra-op.	Post-op. (1 month)
Mean	14.25	16.4	15.42	3.11	39.28	31.17
SD	6.46	6.59	6.66	3.83	5.59	7.17
Range	5-26	6-30	5-30	0-14	32-52	13-40

MMO, Maximum mouth opening; Op, Operative; SD, Standard deviation.

Table IV: Etiology of TMJ ankylosis

Aetiology	**Number of cases (%)**
Trauma	11 (61.11%)
Infection	4 (22.22%)
Neoplastic (Osteochondroma)	1 (5.56%)
Unknown	2 (11.11%)
Total	18 (100%)

Table V: Analyzed data from 18 cases, covering diagnosis, treatment options, and outcomes.

Variables		**Number of cases (%)**	**Mean MMO in mm (SD) (1-month post-op)**	***P*-value†**	**Post hoc (Tukey's HSD)**
Gender	Male	8 (44.45%)	30.12 (5.9)	0.585¶#	-
	Female	10 (55.55%)	32 (7.95)		
Age groups	0-6 (I)	2 (11.11%)	22.5 (9.5)	0.0563#	I vs II#
	7-12 (II)	6 (33.33%)	34.5 (3.99)		I vs III#
	13-18 (III)	5 (27.78%)	27.6 (6.34)		I vs IV#
	19-24 (IV)	3 (16.67%)	35.33 (0.47)		I vs V#
	>24 (V)	2 (11.11%)	30 (5)		II vs III#
					II vs IV#
					II vs V#
					III vs IV#
					III vs V#
					IV vs V#
Side	Bilateral (I)	10 (55.55%)	30.7 (8.38)	0.734#	I vs II#
	Right (II)	3 (16.67%)	29.33 (3.09)		I vs III#
	Left (III)	5 (27.78%)	33.2 (5.71)		II vs III#
Ankylosis type	Osseous (I)	16 (57.14%)	34.4 (4.4)	0.0726#	I vs II#
	Fibrous (II)	8 (28.57%)	32.5 (0.5)		I vs III#
	Fibro-osseous (III)	4 (14.29%)	26.57 (8.48)		II vs III#
Treatment options	GA (I)	7 (38.88%)	34 (6.74)	0.0898#	I vs II#
	IA (TMF) (II)	7 (38.88%)	31 (5.45)		I vs III#
	CT (III)	2 (11.12%)	32.5 (0.5)		I vs IV#
	TMJR (IV)	2 (11.12%)	20.5 (7.5)		II vs III#
					II vs IV#
					III vs IV#

Coronoidectomy	Bilateral (I)	10 (58.82%)	29.7 (7.1)		I vs II #
	Right (II)	4 (23.53)	36.75 (3.7)	0.1477#	I vs III#
	Left (III)	3 (17.65)	27.33 (7.36)		II vs III#
Mouth opening	Pre-op (I)	18	3.11 (3.83)		I vs II***
	Intra-op (II)	18	39.28 (5.59)	0.00001*	I vs III***
	Post-op (1-month) (III)	18	31.17 (7.17)		II vs III**

CT, Condylectomy; GA, Gap arthroplasty; HSD, Honestly significant difference; IP, Interpositional arthroplasty; MMO, Maximum mouth opening; NS, Non-significant; Op, Operative; SD, Standard deviation; TMF, Temporalis myofascial flap; TMJR, TMJ reconstruction; vs, Versus.
*The higher the number of stars, the more significant the difference.
Statistically non significant.
†One-way ANOVA was employed followed by a post hoc (Tukey's HSD) test.
¶ Student's T-test.

This analysis included 18 patients (55.55% of whom were female) who met the inclusion criteria and had their ankylosed TMJ surgically repaired. At the time of surgery, the mean (± SD) age of this patient series was 15.42 years (± 6.66) (range 5–30 years) (Table III), with 7–12 years being the most common age group (Table V). Trauma was the most common etiology (61.11%), followed by infection (22.22%) (Table IV). The result showed a total of 28 TMJa in 18 patients. Bilateral TMJa was found in 10 (55.55%) cases, while unilateral ankylosis was found in 8 (45.55%) individuals, of which 3 (16.67%) on the right side and 5 (27.78%) on the left side (Table V). There were three types of ankylosis found: osseous ankylosis in 16 joints (57.14%), fibrous ankylosis in 8 joints (28.57%), and fibro-osseous ankylosis in 4 joints (14.29%) (Table V). In this study, many surgical intervention options were recorded.

Gap arthroplasty was performed without interposition material in seven cases (38.88%) and with TMF interposition in seven cases (38.88%). Condylectomy was done in 2 (11.12%) patients. TMJ reconstruction by costochondral graft (CCG) was done in 2 (11.12%) patients. Bilateral coronoidectomy was done in 10 (58.82%) cases, while ipsilateral coronoidectomy was done in 7 cases (41.18%). The difference was found to be statistically meaningful ($p < 0.00001$) when mouth opening was evaluated three times in all cases and the mean was compared utilizing ANOVA followed by Tukey's HSD test as follows: pre-operatively (3.11 mm), intra-operatively (39.28 mm), and one month post-operatively (31.17 mm). Postoperative temporary facial nerve paresis (TFNP) was seen in 10 (55.55%) of the cases (Table II). It may be due to excessive traction on the facial nerve during surgery. Such consequences were generally treated conservatively

DISCUSSION:

The preoperative, intra-operative, and postoperative evaluations of 28 joints in 18 patients with TMJa were included in this study; 55.55% were bilateral and 57.17% osseous, in accordance with results from Ethiopia. [11] Patients aged 7–12 years were found to be the most affected in the current study (33.33%), which is consistent with previous studies. [12, 13] In this study, TMJa was shown to be most common among women (55.55%), which is in accordance with previously published reports. [1, 11, 14] TMJa is caused by a variety of factors, including trauma, infection, and previous TMJ operations, but the cause of the proclivity to establish TMJa is unknown. The apparent incidence of TMJa in developing nations and its relative paucity in developed nations is the most remarkable finding in the study. [15] The most frequent cause of TMJa is maxillofacial trauma, which leads to a haematoma that subsequently develops and ossifies. When treating maxillofacial injuries in high-risk individuals like growing children, careful treatment of condylar fractures and early jaw mobilization are crucial. [16] In the current study, trauma was recorded in 11 (61.11%) of the instances, which is comparable to earlier studies from other countries: 86% in India [17], 78% in Ethiopia [11], 85% in Egypt [1], 89% in Morocco [14], and 100% in Jordan [18], and China. [16] This is primarily due to the fact that mandibular condyle fracture is not diagnosed, and the issues are the consequence of delays and/or poor treatment and follow-up.

The primary principles for treating TMJa are adequate ankylotic component excision, if necessary, the placement of an interpositional material, and prompt, active, and intense postsurgical physiotherapy. [2, 3] Varieties of surgical treatment were explored in this retrospective analysis. Gap arthroplasty, condylectomy, and interpositional arthroplasty utilizing TMF with or without ramus-condyle unit restoration employing CCG, were all surgical treatment options. The patient's age, potential for growth, type and complexity of joint ankylosis, extent of facial disfigurement, patient desire and cooperation, and existence of techniques and experience at the time of surgery all influenced the decision to use one or more of these surgical techniques in a particular circumstance. All of these surgical treatment options produced satisfactory outcomes in terms of mouth opening without any significant statistical differences ($p = 0.0898$).

According to the present analysis, the most prevalent approach for treating TMJa, especially in children, is arthroplasty and restoration of the ramus-condyle unit with autogenous CCG. In the restoration of the vertical ramus-condyle joint complex, CCG has been found to be safe and

efficient. [2] Although there are complications such as a fracture at the costochondral junction, pleural rupture, unexpected growth of the reconstructed side following grafting, especially among children, and prolonged chest discomfort and neuritis. [19, 20] In this study, cartilage overgrowth, costochondral junction separation, and donor-site complications like pleural tear, pneumothorax, perichondritis, and pleural effusion were not recorded.

The MMO increased markedly from 3.11 mm pre-operatively to 39.28 mm intra-operatively and 31.17 mm 1 month postoperatively (p = 0.00001). The present and previous study [2, 21] findings emphasize the necessity of early postoperative physiotherapy as a crucial part of TMJa therapeutic effectiveness. Aside from lowering the rate of re-ankylosis, the patients were able to restore or exceed the readings taken during intra-operative mouth opening with intense early post-surgical jaw movements. Although most patients' function and appearance improved after surgery, their dental alignment stayed the same or changed minimally. The occlusion of younger individuals' teeth has gradually improved as their teeth have matured. The remaining dental and skeletal defects were later corrected with orthodontic treatment, orthognathic surgery or DO, and/or onlay grafting procedures. One of the patients had required additional treatment like advancement genioplasty to correct the receding chin. Ten patients experienced temporary and mild facial nerve paresis postoperatively, which was primarily owing to excess flap traction during surgery. There was no irreversible facial nerve injury recorded. Physiotherapy and reassurance were employed to control post-operative facial weakness. Recurrence of ankylosis was not reported in the current study because of the short follow-up period (one month post-operatively). The limitation of this study is the inclusion of a short-term follow-up period. The most important postoperative consequence of TMJa is re-ankylosis. It was not assessed in this study due to the short-term follow-up period. Moreover, intra-operative complications were not recorded.

CONCLUSIONS:

Timely surgical excision of TMJa, ramus height restoration employing DO or bone grafting, interpositional arthroplasty, and intensive physiotherapy were found to be a beneficial approach for TMJa management. Despite the possible complications with CCG that have been observed in certain prior studies, it should be the preferable treatment for patients who are growing. Because donor site morbidity is avoided and the procedure's difficulty is reduced, DO is becoming more acceptable in the treatment of TMJa.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

REFERENCES:

1. Elgazzar R, Abdelhady A, Saad K, Elshaal M, Hussain M, Abdelal S. Treatment modalities of tmj ankylosis: experience in Delta Nile, Egypt. *Int J Oral Maxillofac Surg* 2010; 39:333-42. https://doi.org/10.1016/j.ijom.2010.01.005
2. Kaban L, Perrott D. A protocol for management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg* 1990: 48: 1145–51.
3. Sarma U, David P, Delhi N. Temporamandibular joint ankylosis: An Indian experience. *J Oral Surg Oral Med Oral Pathol* 1991; 72(6):660-4. https://doi.org/10.1016/0030-4220(91)90006-x
4. Sawhney C. Bony ankylosis of the temporomandibular joint: follow-up of 70 patients treated with arthroplasty and acrylic spacer interposition. *Plast Reconstr Surg* 1986; 77 (1): 29-40. https://doi.org/10.1097/00006534-198601000-00007
5. Adekeye E. Ankylosis of the mandible: analysis of 76 cases. *J Oral Maxillofac Surg* 1983; 41(7):442-9. https://doi.org/10.1016/0278-2391(83)90129-5
6. Raveh J, Vuillemin T, Lädrach K, Sutter F. Temporomandibular joint ankylosis: Surgical treatment and long-term results. *J Oral Maxillofac Surg* 1989; 47(9):900-6. https://doi.org/10.1016/0278-2391(89)90371-6
7. Kaban L, Bouchard C, Troulis M. A protocol for management of temporomandibular joint ankylosis in children. *J Oral Maxillofac Surg* 2009; 67(9):1966-78. https://doi.org/10.1016/j.joms.2009.03.071
8. Upadya V, Bhat H, Rao B, Reddy S. Classification and surgical management of temporomandibular joint ankylosis: a review. *J Kor Assoc Oral Maxillofac Surg* 2021; 47(4):239-48. https://doi.org/10.5125/jkaoms.2021.47.4.239
9. Chossegros C, Guyot L, Cheynet F, Blanc J, Gola R, Bourezak Z, *et al*. Comparison of different materials for interposition arthroplasty in treatment of temporomandibular joint ankylosis surgery: long-term follow-up in 25 cases. *Br J Oral Maxillofac Surg* 1997; 35(3):157-60. https://doi.org/10.1016/s0266-4356(97)90554-4
10. Kearns G. Subjective and objective assessment of the temporalis myofascial flap in previously operated temporomandibular joints. *J Oral Maxillofac Surg* 1999; 57(9):1065-7. https://doi.org/10.1016/s0278-2391(99)90326-9
11. Mekonnen D, Gizaw A, Kebede B. Temporomandibular joint ankylosis among patients at saint paul's hospital millennium medical college, Ethiopia: a 9-year retrospective study. *Int J Dent* 2021; 2021:1-6. https://doi.org/10.1155/2021/6695664
12. Potdar S, Devadoss V, Choudary N, Tiwari R, Pandey P and Mahajan S. Epidemiological study of temporomandibular joint ankylosis cases in a tertiary center. *Int J Appl Dent Sci*. 2019; 5:142-5.
13. Eltohami I, Abuaffan A, Alsagh R, Abdalgadir A, Mohamed H, Ali A. Temporomandibular joint ankylosis pattern, causes and management among a sample of Sudanese children. *J Dent Craniofac Res* 2017; 2:6-9. https://doi.org/10.21767/2576-392X.100006
14. Zakaria A, Salma A, Jinane K, Naouar I, Nadia M. Temporomandibular joint ankylosis: an epidemiological study in Marrakesh. *Am J Medic Sci Med* 2018; 6:37-40. https://doi.org/10.12691/ajmsm-6-2-4
15. Rishiraj B, McFadden LR. Treatment of temporomandibular joint ankylosis: a case report. *J Can Dent Assoc* 2001: 67: 659–63.
16. He D, Ellis E, 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. https://doi.org/10.1016/j.joms.2007.08.013
17. Roychoudhury A, Parkash H, Trikha A. Functional restoration by gap arthroplasty in temporomandibular joint ankylosis. *Oral Surg Oral Med Oral Pathol Oral Radio Endo* 1999; 87(2):166-9. https://doi.org/10.1016/s1079-2104(99)70267-2
18. Qudah M, Qudeimat M, Al-Maaita J. Treatment of TMJ ankylosis in Jordanian children – a comparison of two surgical techniques. *J Craniomaxillofac Surg* 2005; 33(1):30-6. https://doi.org/10.1016/j.jcms.2004.07.005
19. Sharma H, Chowdhury S, Navaneetham A, Upadhyay S, Alam S. Costochondral graft as interpositional material for TMJ ankylosis in children: a clinical study. *J Maxillofac Oral Surg* 2015; 14(3):565-72. https://doi.org/10.1007/s12663-014-0686-9
20. Rahman A. Autogenous grafts for condylar reconstruction in the treatment of temporomandibular joint ankylosis: a systematic review on current concepts. *J Dent Res Rev* 2021; 8:233-40. https://doi.org/10.4103/jdrr.jdrr_98_21
21. Matsuura H, Miyamoto H, Ishimaru J, Kurita K, Goss A. Effect of partial immobilization on reconstruction of ankylosis of the temporomandibular joint with an autogenous costochondral graft: an experimental study in sheep. *Br J Oral Maxillofac Surg* 2001; 39(3):196-203. https://doi.org/10.1054/bjom.2001.0623

Cite this article:
Rahman AFMS, Hosen MI, Towhid SJ, Talukder MAH, Hasan MI, Shah MSH, Hossain MA. Treatment Options of Temporomandibular Joint Ankylosis at a Tertiary Level Hospital in Bangladesh: A Two-Year Retrospective Analysis. Update Dent. Coll. j.; 12(2):7-13.
Available from:
https://www.banglajol.info/index.php/UpDCJ/article/view/58354