

## Childhood Chin Trauma and Temporomandibular Joint Ankylosis (TMJ): Retrospective Study

ALMODDATHER M. EL-HADIDY, M.D.; AHMED A.M. KHALIL, M.D. and HOSSAM EL-DIN ALI, M.D.

The Plastic and Reconstructive Surgery Unit, Faculty of Medicine, Mansoura University, Egypt

### ABSTRACT

*Objective:* To study the relationship between the childhood chin trauma and the TMJ ankylosis and to assess our experience which is better for clinical and aesthetic outcome of TMJ ankylotic patients; the using of distraction osteogenesis before or after the resection of the ankylotic joint.

*Patients and Methods:* This study involved 18 patients; 11 males and 7 females presented long-standing TMJ ankylosis with a previous history of chin trauma before the age of 10 years. Their ages ranged from 14 to 25 years. Distraction osteogenesis was used in all patients before or after the resection of the ankylotic mass and the joint reconstructed by costochondral graft and an interpositional temporalis myofascial flap. Follow-up period ranged from 15 to 36 months.

*Results:* The postponed resection of the TMJ ankylosis to the second stage of surgery after distraction osteogenesis gave us the favorable results rather than the distraction osteogenesis came as the second stage.

*Conclusion:* There is a direct relationship between the neglected childhood chin trauma and TMJ ankylosis. Furthermore, the mandibular distraction osteogenesis before the resection the TMJ ankylosis is an effective in the management of TMJ ankylosis.

### INTRODUCTION

Childhood injuries to chin resulting in mandibular condylar fracture are common [1]. Falls are the most common cause of mandibular condylar fracture with chin trauma among children below 10 years of age [2]. The condylar fractures in children are often difficult to diagnose [3]. This difficulty returned to one of the following causes; difficult evaluation and history taking from child, the trouble in obtaining plane radiographs, the poor quality of radiographs and overlap of multiple anatomic structure of the small pediatric skull. In addition, the presence of other injuries in the acute stage elsewhere in the body may add to the difficulty in diagnosis [4,5,6]. Failure to recognize the presence of a condylar fracture may translate into

late complications. Temporomandibular joint (TMJ) ankylosis is the most serious complication of condylar fracture [7].

Patients with TMJ ankylosis usually have speech impairment, difficult mastication, poor oral hygiene, dental caries and various degrees of anatomical facial deformities including microgenia, reduced facial height, poor jaw neck definition and more occlusal canting in unilateral TMJ ankylosis due to hypoplasia on the affected side [8]. The treatment of TMJ ankylosis requires restoration of proper mandibular form, length and vertical dimension, occlusal stability and satisfactory joint movement. With children, future symmetrical growth must also be considered [9].

The aim of this retrospective study was to study the relationship between the childhood chin trauma and the TMJ ankylosis and to assess our experience which is more better for clinical and aesthetic outcome of TMJ ankylotic patients; the using of distraction osteogenesis for correction of facial deformities before or after the resection of the ankylotic joint with coronoidectomy and reconstruction by the autogenous costochondral graft which is wrapped with interpositional temporalis myofascial flap.

### PATIENTS AND METHODS

This retrospective study included 18 patients presenting with long-standing TMJ ankylosis with a previous history of chin trauma before the age of 10 years from 2001 to 2009. The presenting complaint was inability of mouth opening, difficult chewing, difficult breathing, sleep troubles and facial deformity. There were 11 (61.1%) males and 7 (38.9%) females. Their ages at presentation ranging from 14 to 25 years (mean 18 years). Seven of them were unilateral and 11 bilateral. Three

patients had recurrent ankylosis after previous failed surgery.

Eleven patients were undertaking the distractor application in the 1<sup>st</sup> surgical stage. Three months later, the 2<sup>nd</sup> surgical stage including the resection of the ankylotic mass with coronoidectomy and reconstruction by costochondral graft with intervention of an interpositional temporalis myofascial flap. While the remaining cases underwent the resection of the ankylotic mass with coronoidectomy and reconstruction by costochondral graft with intervention of an interpositional temporalis myofascial flap. After 3 months, the mandibular distractor was applied. Intraoral distractor was used in 7 cases and an external distractor was used in the remaining patients.

#### *Preoperative evaluation:*

The preoperative evaluation included a patient history, physical examinations, radiological investigations and photography was taken for all patients. A patient history included patient's age, sex, history of previous trauma, medical condition and complaint at presentation. Physical examinations involved presence or absence of any scar mark under chin, any facial asymmetry at presentation, jaw movements and measuring of maximal mouth opening. Radiological investigations included panoramic view, facial CT scan and MRI (Fig. 1).

#### *Surgical procedures:*

The procedures were performed under general anesthesia and intubation either nasotracheal with the aid of fibroptic laryngoscope or via elective tracheostomy.

#### *A- Distractor application (Figs. 2-6):*

An intraoral approach was made along the anterior border of the ramus. Subperiosteal elevation on both surfaces of ramus and corticotomy were done. The intraoral distractor device was applied through the same approach. While external distractor was applied through a small stab incision extraorally by a trocar system. Our vector is oblique over the angle to do distraction in both directions towards the ramus and the body. The distractor was fixed to the lateral surface of the mandible with its rods and the mandibular osteotomy was completed through green stick fracture in the ramus to preserve the inferior alveolar pundle. Then, the distractor was secured in its position. After the latent period, distraction was performed at a rate of 0.5mm daily until satisfaction results were gained. After the consolidation period (3 months), the distraction device was removed.

#### *B- Resection of the ankylotic mass with coronoidectomy and reconstruction by costochondral graft with intervention of an interpositional temporalis myofascial flap (Figs. 7-11):*

The TMJ was surgically explored through a standard preauricular approach with temporal extension. The ankylotic mass (disc, condylar head, and root of the zygomatic arch) and the coronoid process were exposed and excised using a surgical burs and osteotomies. Through the same approach, pterygo-massetric sling was disinserted and in some patients via a separate approach extraorally (Risdon approach). Maximum mouth opening was tried with demo work on seeing of the space of excised ankylotic mass and measured the maximum interincisal distance. Then, the IMF was applied.

The costochondral graft was taken from the 7<sup>th</sup> rib and the wound was closed in layers. The harvested graft involved 3-5cm bone and 0.5cm cartilage. The graft was trimmed and multiple partial thickness bur holes were made in the graft and the recipient surface of the mandible. Then, the graft was placed on the lateral surface of the ramus as an onlay graft.

The inferiorly based temporalis myofascial flap was used as a wrap over the costochondral graft mimic normal joint. In all patients, a vacuum drain was inserted for 48 hours and the overlying tissues were closed in layers and dressed.

#### *Post-operative protocol:*

Caring of respiration was seriously monitoring. Prophylactic antibiotics, analgesics and anti-inflammatory medications for one week were described for all patients. They were discharged 3 to 5 days postoperatively. The IMF was removed after two weeks. Oral hygiene and fluids were recommended for two weeks then soft food for another four weeks.

All patients underwent physical therapy including home training and physiotherapy. Home training involved frequent chewing of gums and wooden tongue depressor application three times daily for 15-20 minutes for each time with increasing the number of depressors for 3 weeks to gain maximum mouth opening. The maximum mouth opening was measured after one month. All patients were seen weekly for 6 weeks. Follow-up period ranged from 15 to 36 months.

## **RESULTS**

The results of our study (Table 1) were depended on the clinical observations, maximal mouth opening and panoramic view.

Table (1): Patients parameters.

No.	Age (year)	Sex	Ankylotic side	Maximum mouth opening (mm)		Postoperative (1 month later)	Follow-up period (month)
				Latent period (day)	Preoperative		
1	16	M	Unilateral [L]	5	7	41	36
2	14	F	Unilateral [L]	6	0	27	30
3	18	M	Bilateral	7	2	28	24
4	25	M	Bilateral	7	2	30	24
5	16	F	Unilateral [R]	7	0	24	24
6	18	M	Bilateral	6	3	35	20
7	15	F	Unilateral [L]	7	2	32	20
8	23	M	Bilateral	6	4	32	20
9	18	M	Bilateral	7	2	29	20
10	23	M	Bilateral	7	2	32	20
11	21	M	Bilateral	7	3	30	18
12	14	F	Unilateral [R]	6	4	34	18
13	17	F	Bilateral	5	5	29	18
14	19	M	Bilateral	5	0	34	18
15	14	F	Unilateral [L]	7	0	34	18
16	14	F	Unilateral [L]	7	3	34	17
17	16	M	Bilateral	7	3	35	16
18	23	M	Bilateral	5	2	32	15
Mean	18			6.33	2.44	31.78	20.89

All patients tolerated the surgical procedures and recovered well. Anaesthetized patients with the aid of fibroptic laryngoscope were more calm, easily breath, well recover and early return to their life activity.

Patients with intraoral distraction device were more satisfied than those with external distraction device because they were returned back to perform their normal activity. Two patients reported losing the supporting screws of their external devices. The distraction osteogenesis was achieved successfully in all patients with good bone formation which documented radiologically. Three patients, who released TMJ ankylosis firstly, experienced pain in the ipsilateral TMJ during the distraction period. No wound infection was reported. Mild skin infection was found around the external distraction rods in 5 patients that healed after application of topical antibiotics.

The clinical observations showed nearly symmetrical facial appearance (Figs. 12,13), horizontal occlusal plane (Fig. 14) with improvement of occlusion. In addition, breath and sleep behavior were improved as a result of upper airway improvement and the mouth room became capacious in all patients. An important finding was good joint

function with an adequate range of mandibular movement and pain free inspite of the absence of the condyle. The mean of maximum interincisal opening was 2.44mm preoperatively and 31.78mm postoperatively (Fig. 15) after a mean follow-up period of 20.89 months. Re-ankylosis was reported in 2 patients who underwent the release of TMJ ankylosis firstly before the distraction process. Facial scar was an unsatisfactory result in 7 patients.

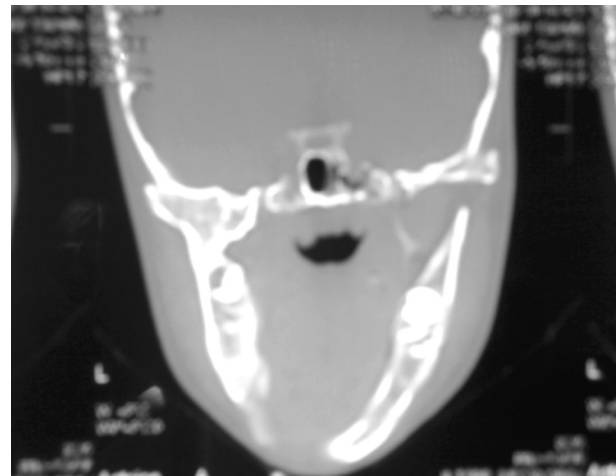


Fig. (1): Facial CT scan showed left TMJ ankylosis.



Fig. (2): Intraoral approach and corticotomy.



Fig. (3): Intraoral distractor application.



Fig. (4): Extraoral approach and corticotomy.

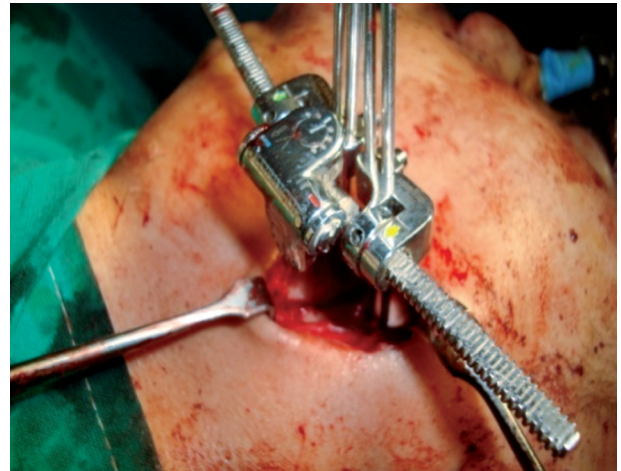


Fig. (5): External distractor application.

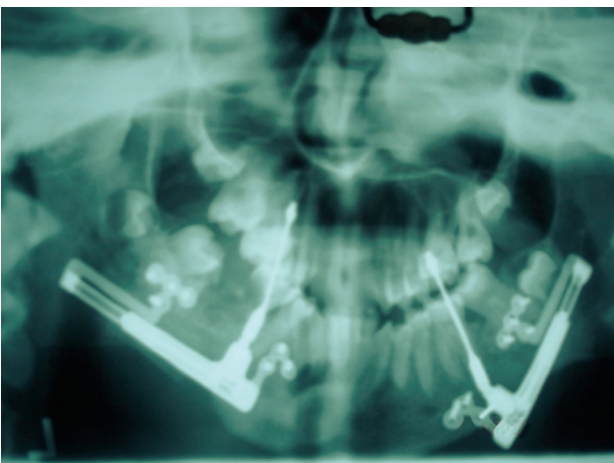


Fig. (6): Panoramic view during distraction period.



Fig. (7): Standard preauricular approach.



Fig. (8): Exposure and excision of ankylotic mass.



Fig. (9): Harvesting of costochondral graft.

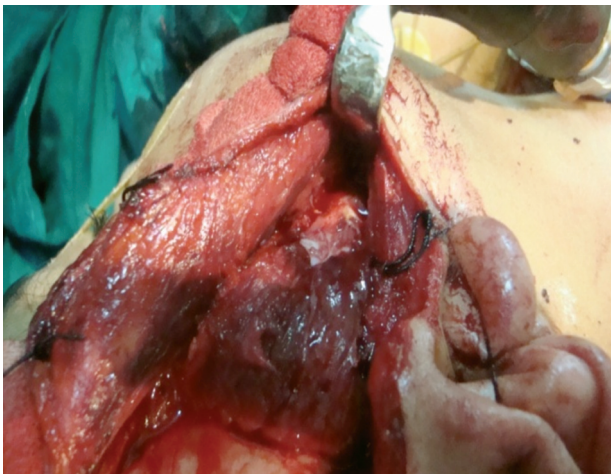


Fig. (10): Placing the graft and wrap temporalis myofascial flap.

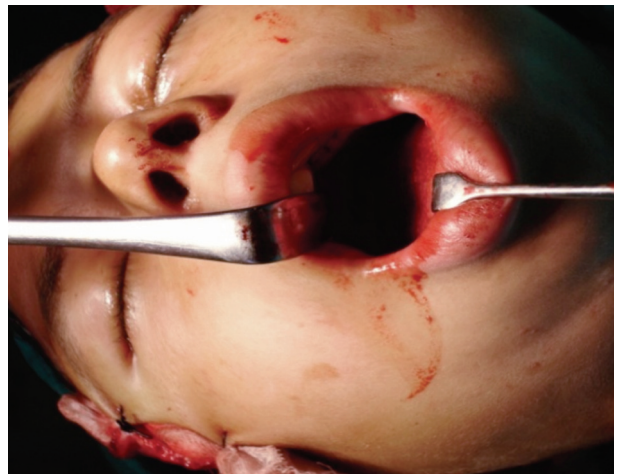


Fig. (11): Open the mouth and measure the maximum mouth opening.



Fig. (12): Pre and post-operatives facial appearance (Frontal view).

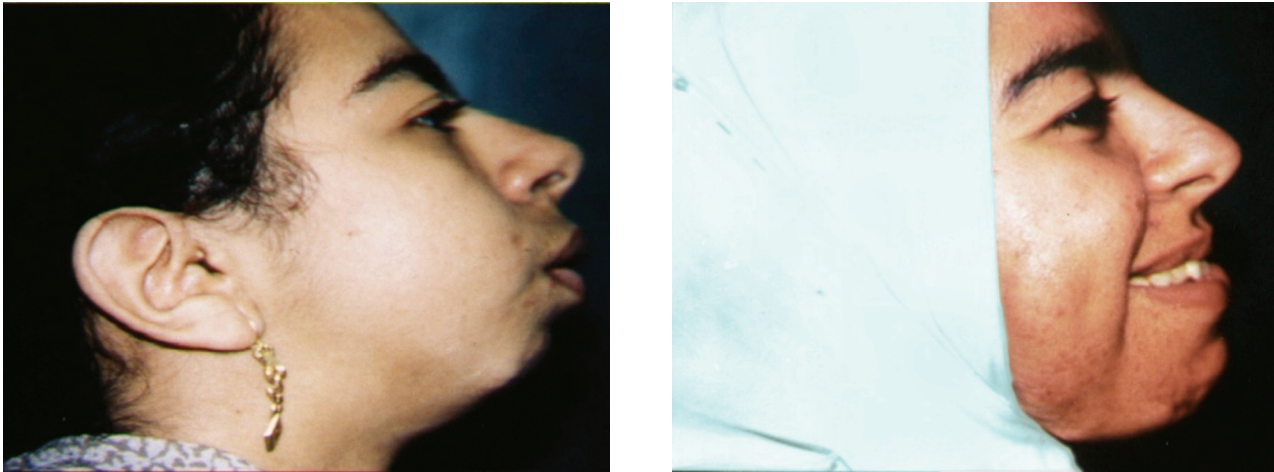


Fig. (13): Pre and post-operatives facial appearance (Lateral view).



Fig. (14): Pre and post-operatives occlusal plane.



Fig. (15): Pre and post-operative maximum interincisal distance.

## DISCUSSION

Many studies [10-13] reported that the trauma was the most common aetiology of TMJ ankylosis (13-100%). Khan et al., 2010 found that trauma was the most common cause of TMJ ankylosis and was confirmed in 96.7% of patients by an obvious scar mark under their chin and a history of chin trauma before the age of 10 years [14]. This study was agreed with the previous studies as the trauma was the most common cause of TMJ ankylosis. Moreover, the neglected diagnosis and the badly management hematoma of the TMJ were progressed up to fibrosis and ultimately to ankylosis.

Majority of post-traumatic TMJ ankylosis was primarily attributed to delay or non-treatment of condylar fractures due to several factors such as poor educational levels, non-availability of surgical expertise, poor economic status and prolonged immobilization of the joint due to pain after injury [15].

Our objective in the management of the TMJ ankylosis was to restore mouth opening, to establish a function outcome of the joint, to correct the facial profile and to relieve the upper airway obstruction with minimal complications.

Reconstruction of the mandibular condyle remains a challenge because of its unique anatomical structure. Autogenous graft is generally considered the best reconstruction material as it is less in cost and time for preparation in comparison with allograft and it heals normally with little complications [16]. Costochondral graft is the most widely accepted autogenous technique for mandibular condyle reconstruction. The costochondral graft is readily available, possesses good mechanical properties and has the capacity for remodeling into an adaptive mandibular condyle [17].

The unpredictable growth pattern of the costochondral grafts has often been cited as a disadvantage. Aberrant growth can cause progressive dental midline shifts, occlusal changes, chin deviation and enlargement of the graft itself [18].

When treating the TMJ ankylosis with costochondral graft in this study, the good healing of the costochondral graft with the mandibular ramus was confirmed and most patients showed no re-ankylosis in spite of Saeed and Kent in 2003 reported re-ankylosis and limited improvement in mouth opening [13]. Our explanation regarded to use an adequate amount of myofascial temporalis muscle flap as an interpositional graft was effective in the prevention of ankylosis recurrence. The main ad-

vantages of using the autogenous myofascial temporalis muscle flap are its proximity to the operative site and its good blood supply.

Since McCarthy use a distraction technique for mandibular lengthening in the patients with hemifacial microsomia [19], Distraction osteogenesis has become a widely accepted natural surgical procedure in the treatment of craniofacial deformities and defects. Several series [20,21,22] confirmed that distraction osteogenesis is a promising treatment option for patients with TMJ ankylosis. Distraction osteogenesis has become a popular surgical modality due to many advantages: minimal complexity of the procedure, minimal operative time, minimal hospital stay, low risk of complications, no donor site morbidity, no need for blood and no IMF fixation required [23].

Muscular resistance, particularly from masseter and medial pterygoid muscles is one of the most crucial factors in creating resistance during distraction osteogenesis, as well as during jaw exercises after releasing the ankylosis [23]. So, in this series the preygo-masseteric sling was disinserted freely that resulting in maximal mouth opening.

The authors regarded the reported experienced pain during the distraction period to the distraction forces pushing the remaining ramus up into the glenoid fossa.

We observed that the postponed resection of the TMJ ankylosis to the second stage of surgery after distraction osteogenesis gave us the favorable results rather than the distraction osteogenesis came as the second stage. This emphasizes that the immobile joint represented a fixed point that the distraction was pushed the mandible downward for mandibular lengthening with no harm effect on the non-reconstructed joint. Moreover, the enlarged bone segment in this stage appreciates the convenient osteotomy and appropriate placing of the costochondral graft in the second stage. On the other hand, the resection of TMJ ankylosis firstly and the distraction osteogenesis came later, it is going to lengthen the ramus towards the reconstructed joint destroying it and may hasten the ankylosis again.

From the current study, the authors summarize and conclude that there is a direct relationship between the neglected childhood chin trauma and TMJ ankylosis. So, we recommend to do ultrasonography on the TMJ with regular follow-up to examine the TMJ function as a routine for any patient with mandibular trauma. Furthermore, the mandibular distraction osteogenesis before the

resection the TMJ ankylosis is an effective in the management of TMJ ankylosis and the advantage of the postponing resection of the ankylotic joint is prevention of the rotation and the upward movement of the mandibular ramus during the distraction course.

## REFERENCES

- 1- Holan G.: Traumatic injuries to chin: A survey in a paediatric dental practice. *International Journal of paediatric dentistry*, 8: 143-48, 1998.
- 2- Ogunlewe M.O., James O., Ladeinde L.A. and Adeyemo W.L.: Pattern of paediatric maxillofacial fractures in Lagos, Nigeria. *International Journal of Paediatric Dentistry*, 16: 358-62, 2006.
- 3- Tejani Z., Johnson A., Mason C. and Goodman J.: Multiple crown root fractures in primary molars and a suspected subcondylar fracture following trauma: A report of a case. *Dental Traumatology*, 24: 253-56, 2008.
- 4- Lee C.Y.S., Mc Cullon C., Blaustein D. and Mohammadi H.: Sequelae of unrecognized, untreated mandibular condylar fractures in the pediatric patients. *Ann. Dent.*, 52: 5-8, 1993.
- 5- Dimitroulis G.: Condylar injuries in growing patients. *Australian Dental Journal*, 42 (6): 367-71, 1997.
- 6- Oji C.: Fractures of the facial skeleton in children: A survey of patients under the age of 11 years. *Journal of Cranio-Maxillofacial Surgery*, 26: 322-25, 1998.
- 7- Ferretti, Bryant R., Becker P. and Lawrence C.: Temporomandibular joint morphology following post-traumatic ankylosis in 26 patients. *Int. J. Oral Maxillofac. Surg.*, 34: 376-81, 2005.
- 8- Perrott D.H., Umeda H. and Kaban L.B.: Costochondral graft construction/reconstruction of the ramus/condyle unit: Long-term follow-up. *Int. J. Oral Maxillofac. Surg.*, 23: 321-28, 1994.
- 9- Kaban L.B., Perrott D.H. and fisher K.: A protocol for management of temporomandibular joint ankylosis. *J. Oral Maxillofac. Surg.*, 48: 1145-51, 1990.
- 10- Demir Z., Velideglu H., Sahin U., Kurtay A. and Coskunfirat O.K.: Preserved costal cartilage homograft application for treatment of temporomandibular joint ankylosis. *Plast. Reconstr. Surg.*, 108: 44-51, 2001.
- 11- El-Sheikh M.M. and Medra A.M.: Management of unilateral temporomandibular joint ankylosis associated with facial asymmetry. *J. Craniomaxillofac. Surg.*, 25: 109-15, 1997.
- 12- Miyamoto H., Kurita K., Ogi N., Ishimaru J.I. and Goss A.N.: The effect of an intra-articular bone fragment in the genesis of the temporomandibular joint ankylosis. *Int. J. Oral Maxillofac. Surg.*, 29: 290-95, 2000.
- 13- Saeed N.R. and Kent J.N.: A retrospective study of the costochondral graft in TMJ reconstruction. *Int. J. Oral Maxillofac. Surg.*, 32: 606-9, 2003.
- 14- Khan Z., Alam J., Khan S., Abid H. and Warraich R.A.: Correlation between childhood chin trauma, condylar fracture & TMJ ankylosis. *Pakistan Oral & Dental Journal*, 30 (1): 47-51, 2010.
- 15- Jain, et al.: Temporomandibular joint ankylosis: A review of 44 cases. *Oral Maxillofac. Surg.*, 12: 61-66, 2008.
- 16- MacIntosh R.B.: The use of autogenous tissues for temporomandibular joint reconstruction. *J. Oral Maxillofac. Surg.*, 58: 63-69, 2000.
- 17- Matsuura H., Miyamoto H., Kurita K. and Goss A.N.: The effect of autogenous costochondral grafts on temporomandibular joint fibrous and bony ankylosis: A preliminary experimental study. *J. Oral Maxillofac. Surg.*, 64: 1517-25, 2006.
- 18- Ko E.W., Huang C. and Chen Y.: Temporomandibular joint reconstruction in children using costochondral grafts. *J. Oral Maxillofac. Surg.*, 57: 789-98, 1999.
- 19- McCarthy J.G., Schreiber J. and Karp N.: Lengthening the human mandible by gradual distraction. *Plast. Reconstr. Surg.*, 89: 1-8, 1992.
- 20- Stucki-McCormick S.U.: Reconstruction of the mandibular condyle using transport distraction osteogenesis. *J. Craniofac. Surg.*, 8: 48-52, 1997.
- 21- Cheung L.K. and Lo J.: The long-term effect of transport distraction in the management of temporomandibular joint ankylosis. *Plast. Reconstr. Surg.*, 119: 1003-9, 2007.
- 22- Schwartz H.C. and Relle R.J.: Distraction osteogenesis for temporomandibular joint reconstruction. *J. Oral Maxillofac. Surg.*, 66: 718-23, 2008.
- 23- Sadakah A.A., Elgazzar R.F. and Abdelhady A.I.: Intraoral distraction osteogenesis for the correction of facial deformities following temporomandibular joint ankylosis: A modified technique. *Int. J. Oral Maxillofac. Surg.*, 35: 399-406, 2006.