

# Temporomandibular joint ankylosis: the Egyptian experience

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This is a review of 204 patients with temporomandibular joint (TMJ) ankylosis treated according to a definitive protocol in the Cranio-Maxillo-Facial Department of the Alexandria University Hospital during the period 1990–1996 with a follow-up varying from 1.5 to 7 years. A history of trauma was confirmed in 98% of cases. Patients were grouped into: (1) Those with ankylosis not associated with facial deformities. The management involves release of the ankylosed joint(s) and reconstruction of the condyle ramus unit(s) (CRUs) using costochondral graft(s) (CCGs). (2) Those with mandibular ankylosis complicated by facial bone deformities, either asymmetric or bird face. The treatment consists of release of the ankylosis, reconstruction of the CRUs, and correction of jaw deformities—all performed simultaneously. Respiratory embarrassment was an important presenting symptom in the second group, all of whom complained of night snoring, eight of whom had obstructive sleep apnoea (OSA). In this latter group, respiratory obstruction improved dramatically after surgical intervention. The degree of mouth opening, monitored as the interincisal distance (IID) improved from a range of 0–12 mm to over 30 mm in 62% of patients and to 20–30 mm in 29% of patients. However, re-ankylosis was still around 8% and was attributed to lack of patient compliance in 75% and to iatrogenic factors in 25% of patients. CCGs resorption, whether partial or complete, occurred in 27% of patients,

resulting in retarded growth, relapse of deformities and night snoring.

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That John Hunter (1728–1793) was interested in joints is undisputed and specimens are extant in his collection and casebook. His fascination with the masticatory mechanism, the teeth and jaws is equally well documented in *The Natural History of Human Teeth* parts I and II (1771 and 1778) (1). With the posthumous dispersal of the collection, little remains to show Hunter's interest in 'mandibular ankylosis'. In view of the number of eighteenth- and nineteenth-century specimens in British medical museums, it is highly improbable that he would not have encountered such a case and described it in his inimitable fashion. Among the pioneers in this field was Norman Rowe (1915–1991) who wrote an excellent monograph on the management of 46 patients with temporomandibular joint (TMJ) ankylosis, half of them referred from the Middle East (2).

The management of TMJ ankylosis has always been difficult and frustrating, particularly when dealing with long-standing or recurrent cases, or if the case is complicated by deformities of the jaw bones. It can be extremely problematical when the patient's compliance is limited, especially in the younger age group or when they come from far or rural areas where postoperative follow-up is expected to be difficult. The Cranio-Maxillo-Facial Department of Alexandria University was established in 1968; since then it has been a place of referral for most patients with TMJ ankylosis. An average of 30 patients are referred annually from all over the country (65 million population). In our early experience, the recurrence rate was 7% and the postoperative results were unacceptable (3). Since 1990, a treatment protocol has been instituted for the management of such patients. The aim of this

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article is to present the experience gained from the management of this problem during the period January 1990 to December 1996.

## Patients

This study reviews 204 patients with TMJ ankylosis. The aetiology of the disease, age and sex of patients and the duration of symptoms are shown in Table I. The presenting symptoms, whether the case is uni- or bilateral and if the condition is primary or recurrent are shown in Table II.

## Management

### Surgical procedure

The basic surgical treatment is varied according to whether the case is associated with facial deformities or not and whether it is unilateral or bilateral.

#### *Ankylosis not associated with facial deformities*

Treatment consists of release of the ankylosis and reconstruction of the condyle ramus unit (CRU).

Table I. Aetiology, age, sex and duration of symptoms in 204 patients with TMJ ankylosis

	No. of patients (%)
Aetiology	
Trauma	201 (98.5)
Congenital	2 (1)
Infection	1 (0.5)
Age	
Children (< 14 years)	84 (41)
Adults (> 14 years)	120 (59)
Sex	
Male	98 (48)
Females	106 (52)
Duration: Shortest, 6 months; Longest, 37 years; Mean (8 years)	

Table II. Clinical data of 204 patients with TMJ ankylosis

Presenting symptoms	No. (%)
Limitation of mouth opening	204 (100)
Facial deformity	82 (40)
Respiratory problems	
Night snoring	53 (26)
Obstructive sleep apnoea	8 (4)
Infected teeth	34 (17)
Unilateral	140 (69)
Bilateral	64 (31)
Primary (not operated before)	185 (91)
Recurrent (re-ankylosis)	19 (9)

*Release of ankylosis.* A Risdon's incision is made in the retromandibular groove to reach the angle of the mandible for dissection and disinsertion of the pterygomasseteric muscle sling. Care is taken not to injure the mandibular branch of the facial nerve, the lower pole of the parotid gland, or the retromandibular vein.

A preauricular incision with temporal extension is performed, its lower part in a skin crease in front of the auricle, extending into the preauricular space between the glenoid lobe of the parotid gland and the cartilaginous part of the external auditory canal, taking care not to injure this canal. The temporal extension is then made. Dissection is performed either superficial to the deep temporal fascia (4) or deep to it with temporalis muscle splitting (5). The two parts of this incision are then joined and the anterior fasciocutaneous flap is raised and reflected forward in the subperiosteal plane along the zygomatic arch, to reach the zygomatic bone. Full exposure of the ankylosed TMJ and the coronoid process (CP) can be completed by connecting the two incisions. Every effort is made to save the frontal and zygomatic branches of the facial nerve. The attachment of the upper fibres of the masseter muscle is now severed using a diathermy knife.

By dissecting in a subperiosteal plane, one can identify the posterior border of the condylar neck, the anterior border of the CP and the lower extent of the ankylosed mass. Using carbide rose-head burs No. 2, 3 and 4, the ankylosed mass and the CP can easily be resected and removed. Care is taken not to injure the maxillary artery or any of its branches. An attempt is then made to mobilise the mandible. If any resistance is encountered, the other joint being normal, the cause lies in the contralateral CP. This needs resecting via an intraoral approach. Trimming and fashioning of the glenoid fossa is an important part of resecting the ankylosed mass. At this point care is taken not to perforate the skull base or injure the dura.

A hinged flap of the temporalis muscle or its fascia is now fashioned and made to fill the gap left after resection of the bony mass. Any residual disc material can be used for the same purpose. In bilateral cases, the same procedure is repeated on the opposite side.

*Reconstruction of the condyle ramus unit (CRU).* A suitable length of a costochondral graft (CCG) is harvested from ribs No. 4, 5 or 6, via a submammary incision, either from the right or left side. The cartilaginous part does not exceed 2–4 mm, and the perichondral–periosteal junction is preserved to act as a splint in this weak area. The graft and the recipient area of the mandible are decorticated and trimmed to obtain a perfect contact. Fixation of the graft to the lateral surface of the mandibular ramus can be achieved using either transosseous wires or rigidly fixed using two or three 2 mm screws in children or 2.5–2.7 mm screws in adult patients. In bilateral cases, the grafts are harvested from two alternate ribs. Before fixation of the CCGs, the mandibular position is adjusted to achieve the most acceptable occlusion. Postoperative intermaxillary fixation

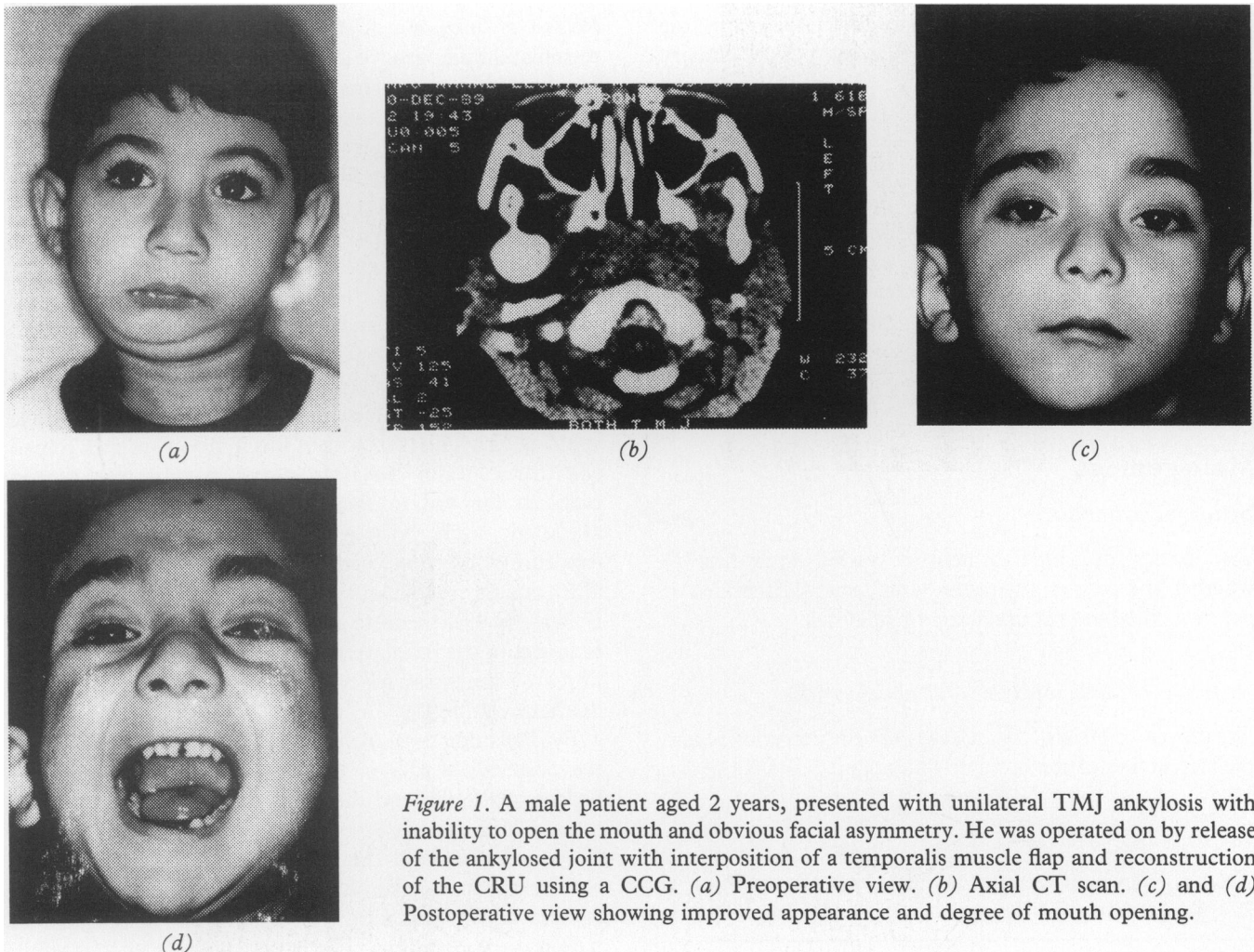


Figure 1. A male patient aged 2 years, presented with unilateral TMJ ankylosis with inability to open the mouth and obvious facial asymmetry. He was operated on by release of the ankylosed joint with interposition of a temporalis muscle flap and reconstruction of the CRU using a CCG. (a) Preoperative view. (b) Axial CT scan. (c) and (d) Postoperative view showing improved appearance and degree of mouth opening.

(IMF) is not needed in unilateral cases, but is necessary in bilateral cases in order to keep the graft in place and relieve it from the stress loading of mastication. This is retained for 3–4 weeks in children and 6–8 weeks in adults. Figure 1 is an example of this case, with the result 3 years postoperatively.

#### *Ankylosis associated with facial deformities*

For this group, the treatment consists of release of the ankylosis, reconstruction of the CRU and correction of the facial deformity, all carried out in one operation.

*Unilateral cases with asymmetric face.* These patients underwent bimaxillary surgery in the form of release of the ankylosis, contralateral vertical ramus osteotomy to bring the chin to the midline, Le Fort I osteotomy to bring the shortened hemimaxilla down and level the occlusal canting with interposition of a bone graft, a costochondral graft to restore the ramal height on the affected side, and an advancement levelling genioplasty (Fig. 2).

*Bilateral cases with bird face.* These patients needed bilateral release of the ankylosed joints, restoration of the posterior facial heights by two costochondral grafts, Le Fort I osteotomy to bring the posterior maxilla down

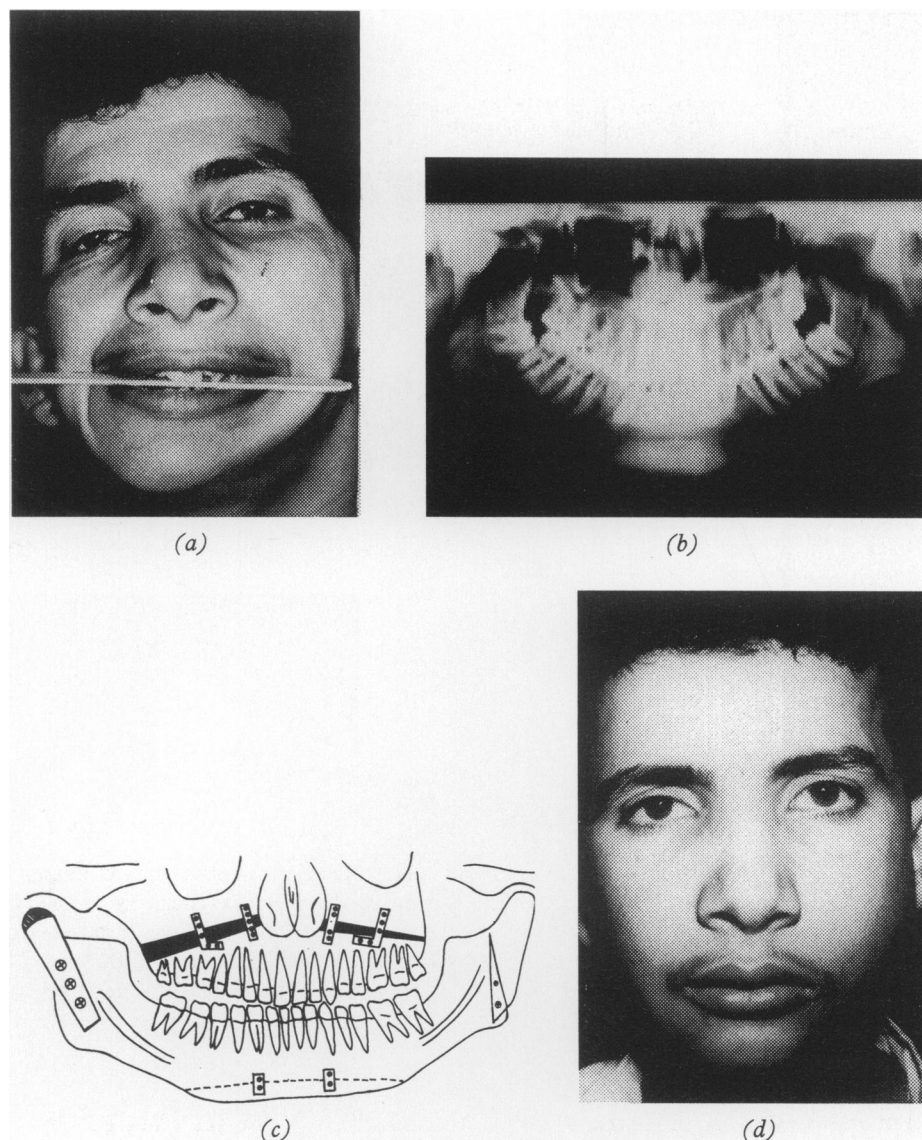
and filling of the resulting gap by split ribs. Lastly, an advancement genioplasty (Fig. 3).

However, in children, both maxillary surgery and genioplasty are contraindicated so as not to injure the developing teeth.

In selected cases, when the ankylosis is unilateral affecting an adult patient with recent history, and when the ankylosing mass is relatively small, without or with minimal deformity, it is justifiable to resect the ankylosing mass and interpose temporalis muscle or fascia in the resulting gap with no reconstruction of the CRU. If genioplasty is indicated, this can be carried out later as an elective procedure (2).

#### **Postoperative care**

Active mouth opening exercises are started immediately after postoperative pain subsides. However, for patients who have undergone IMF, exercises are started soon after release of fixation. Patients are encouraged to start gentle, active and gradually increasing mouth opening exercises using their own fingers as a monitor to start with, in order to gain self-confidence, and they are allowed to take a soft diet. Wooden tongue blades are used thereafter with a gradually increasing number according to the patient's



*Figure 2.* A male patient aged 18 years, presented with right sided TMJ ankylosis with facial asymmetry and occlusal canting. He was subjected to trauma in his early childhood. The operative procedure consisted of release of the ankylosed joint with interposition of a temporalis muscle flap, contralateral vertical ramus osteotomy, reconstruction of the CRU by a CCG, Le Fort I osteotomy with interposition of a split rib graft and genioplasty. (a) Preoperative view. (b) Orthopantomogram. (c) Diagram of operative procedure. (d) Postoperative view.

tolerance, avoiding any passive force or pain. This is performed under strict supervision for 15 min five times a day. Regular weekly visits are arranged during the first month, biweekly for the next 3 months, then monthly for 1 year.

## Results

Patients were recalled annually for evaluation and recording of the degree of mouth opening, aesthetic satisfaction, and improvement of airway embarrassment. Orthopantomography and lateral cephalometry were carried out routinely. Eighteen patients (8.8%) were lost to follow-up. The overall results obtained from 186 patients (91.2%) are summarised in Table II and Table

III. In 16 patients, release of the ankylosis was carried out without reconstruction of CRU, 'gap arthroplasty'.

## Discussion

The high incidence of ankylosis of the TMJ in the Middle East, and north and central Africa is explained by the fact that the medical and dental specialties are concentrated in the big cities. The greatest majority of patients with this problem are referred from rural areas, where the early diagnosis and primary care of fractures of the mandibular condyle are either missed or treated inappropriately. The condition is usually discovered accidentally and late by the parents when they observe that the child is unable to eat or there is some deformity of the face (2,3,6).

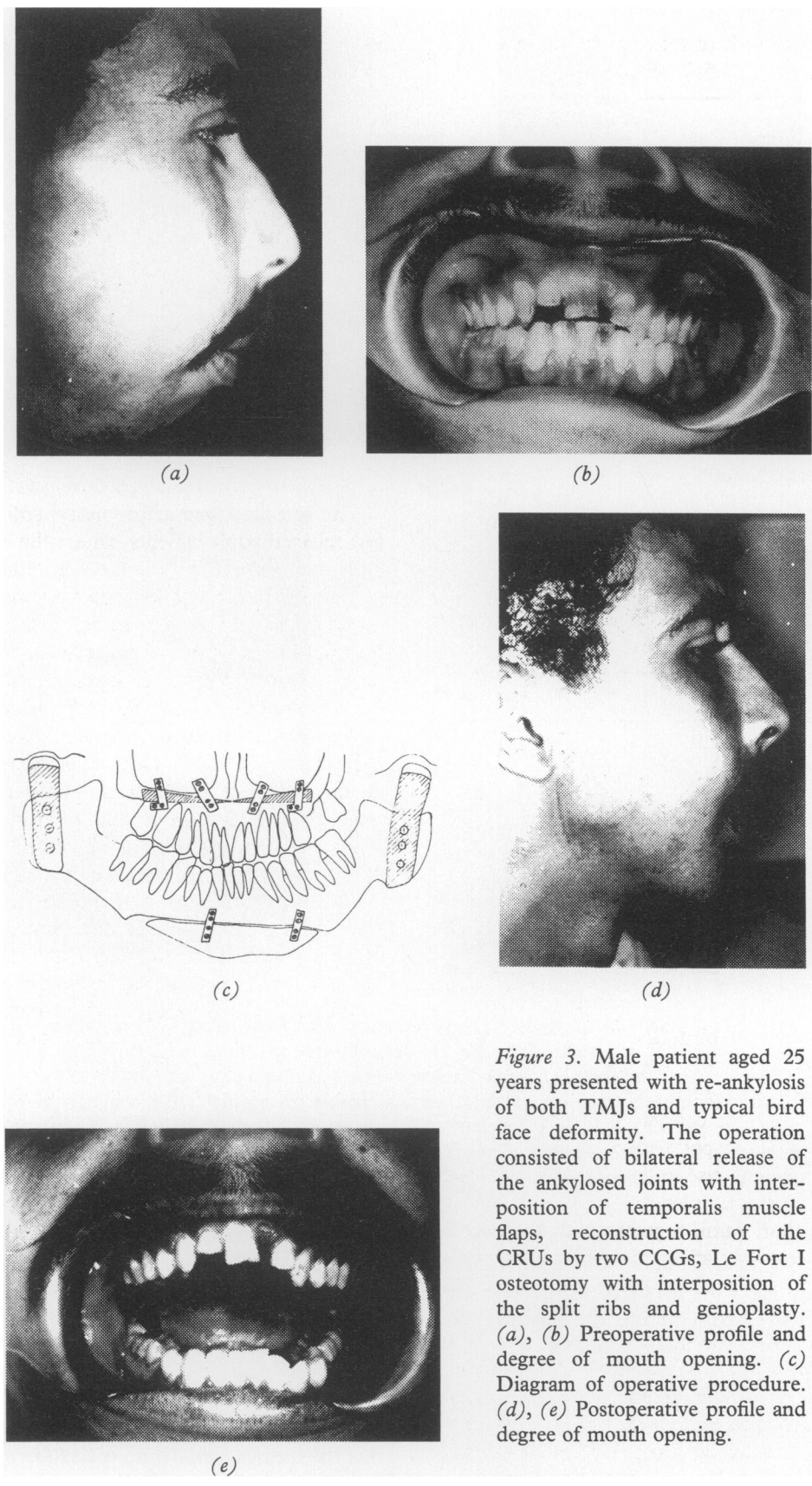


Figure 3. Male patient aged 25 years presented with re-ankylosis of both TMJs and typical bird face deformity. The operation consisted of bilateral release of the ankylosed joints with interposition of temporalis muscle flaps, reconstruction of the CRUs by two CCGs, Le Fort I osteotomy with interposition of the split ribs and genioplasty. (a), (b) Preoperative profile and degree of mouth opening. (c) Diagram of operative procedure. (d), (e) Postoperative profile and degree of mouth opening.

The term congenital ankylosis can be applied to conditions where there is complete bony fusion between the mandibular condyle and the temporal bone, with absence of any trace of intra-articular disc and lateral pterygoid muscle. The two structures develop from the

middle mesenchymal blastema between that of the developing temporal bone and the articular condyle (7). TMJ ankylosis starting during the growth period results in serious deformities of the mandibular shape and size together with the related soft tissue matrix.

Table III. Overall results of treatment of 186 patients with TMJ ankylosis (follow-up 1.5–7 years)

	No. (%)
Degree of mouth opening	
Interincisal distance (IID) ( <i>n</i> = 186)	
Preoperative range 0–12 mm	
Postoperative	
> 30 mm	116 (62)
20–30 mm	54 (29)
< 20 mm	16 (8.6)
Re-ankylosis	
Aesthetic satisfaction ( <i>n</i> = 82)	
Excellent	55 (67)
Good	16 (19.5)
Dissatisfied	11 (13.5)
Airway improvement: ( <i>n</i> = 80)	
Night snoring	58/72 (80)
Sleep apnoea	8/8 (100)

Table IV. Radiographic findings of 210 costochondral grafts in 170 patients (follow-up 1.5–7 years)

	No. (%)
Full take	105 (50)
Resorption	
Complete	31 (14)
Partial	27 (13)
Overgrowth	2 (1)
Displacement	
Anterior	8 (4)
Lateral	2 (1)
Re-ankylosis	16 (8)

Mandibular asymmetry or bird face deformities will be the outcome according to whether the case is uni- or bilateral. Maxillary deformity follows that of the mandible resulting in canting of the occlusal plane in unilateral cases and shortening of the posterior maxillary height in bird face deformity, giving rise to the characteristic steep mandibular and occlusal planes. The retrognathic mandible with its short rami, together with the narrow bigonial distance, seriously affect the dimensions of the oropharynx giving rise to obstruction of the airway at that level. The long-standing ankylosed joints result in chronic isometric contractions of the masticatory muscles. This gives rise to elongation and thickening of the coronoid process (temporalis muscle), shortening of the mandibular ramus/rami (pterygomasseteric muscle sling), recession of the chin and its elongation in a cephalocaudal direction (suprahyoid depressor muscles), and the development of the antegonial notch owing to the antagonistic actions of the pterygomasseteric sling and the depressor muscles.

The treatment of TMJ ankylosis has never been easy because of the wide variations in the clinical features and the methods of the patient's presentation. The treatment strategy varies with age, whether there is facial deformity or not, and if the condition is recent or long-standing.

Innovative and efficient protocols were introduced to solve this problem (2–16).

In children, in addition to the release of ankylosis, the primary concern is to keep the growth potential of the facial skeleton. Thus, reconstruction of the CRUs using CCGs, followed by active mouth opening exercises, is mandatory. In adults, the patient may be satisfied by an operation to provide adequate mouth opening and to resume normal mastication. The treatment is different if the main presentation is that of facial deformity, particularly in teenagers and young adults. In addition to the release of ankylosis, it is essential to correct the facial deformity by one operation in these patients. This was found to give satisfaction to both the patient and surgeon (Figs 1, 2, 3). Other authors have different opinions, where they prefer to release the ankylosis first and defer reconstruction until later (2,17,18).

The so called 'gap arthroplasty' still has its place in a few selected adult patients, where the condition is recent with no secondary changes in the musculoskeletal structures. It can also be indicated when the ankylosing mass is so small that its resection will not affect the ramal height. A mild degree of mandibular deviation has to be accepted when the patient opens the mouth widely (2). It is contraindicated when the ankylosing mass is so large that its resection will considerably compromise the ramal height; also in bilateral cases, as this may result in gagging of the posterior teeth, anterior open bite and, more seriously, respiratory embarrassment. This operation must never be performed in children as it results in serious disturbance of the anticipated mandibular growth.

The most distressing complication of this type of surgery is re-ankylosis. In our experience, over the last 30 years, we have distinguished two aetiological factors: (1) *iatrogenic*, such as (a) incomplete resection of the ankylosing mass leaving residual parts attached to the skull base, (b) leaving the coronoid process, (c) disregarding the pterygomasseteric sling which must have been disinserted at the angle of the mandible, and where previous surgery was performed through a limited preauricular incision, or (d) a 'gap arthroplasty' was carried out with or without an interpositional material. Overemphasis is laid by many authors on the use of non-osteogenic interposition materials, whether autogenous (19–21) or alloplastic (2,3,22), to fill the gap in order to prevent re-ankylosis. This was not found to be valid, as re-ankylosis occurred around these materials in many cases of this series. (2) The second and more common aetiological factor is the *poor compliance* of the patient. The percentage of re-ankylosis was found to be higher in the young age group, in those mentally or socially handicapped, or in those living far away where follow-up was difficult or irregular.

Autogenous CCG is our preferred material for reconstruction of the CRU. The aim is to restore its normal length and function in order to act as a posterior osseous strut with a cartilaginous head. For the mandible to grow and function in a normal way, there must be bilateral rami of equal lengths and freely mobile joints (23–25). This was achieved in 105/210 (50%) of grafts.

Complete or partial resorption of the CCG was a common complication and occurred in 58/210 (27%) of this series, resulting in relapse of the deformity or delayed growth. Graft resorption mostly involved that part projecting above the cut end of the ramus owing to avascular necrosis. The predisposing factors were probably early mobilisation and premature stress loading on the graft, improper coaptation and fixation to the recipient bed, or the graft was too long to take fully, or the case was recurrent with fibrotic bed and poor vascularity. Six patients in this series with graft resorption were corrected by distraction osteogenesis with very satisfactory results.

In conclusion, one must consider five cardinal objectives necessary for the successful treatment of temporomandibular ankylosis:

- 1 The radical resection of the ankylosed mass via wide surgical exposure (14).
- 2 Release of the pterygomasseteric muscle sling(s) with resection of the CPs.
- 3 Restoration of the vertical ramal height and condylar head CRU by a CCG (3–6,13).
- 4 Simultaneous correction of the jaw bone deformities at the same time as release of the ankylosis (4–6,18) and, most importantly,
- 5 Careful selection of the patients who are expected to comply with postoperative functional rehabilitation and regular follow-up for at least 1 year.

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