

Management of Costochondral Graft Overgrowth Following Treatment of Condylar Ankylosis: A Case Report

Azita Tehranchi^a, Hossein Behnia^b, Farnaz Younessian^c, Sattar kabiri^d, Niloufar Azami^{e*}

^a Preventive Dentistry Research Center, Research Institute of Dental Sciences, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ^b Dental Research Center, Research Institute of Dental Sciences, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ^c Dentofacial Deformities Research Center, Research Institute of Dental Sciences, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ^d Department of Orthodontics, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ^e Department of Orthodontics, Dental School, Azad University of Medical Sciences, Tehran, Iran

*Corresponding author: Sattar Kabiri, Department of Orthodontics, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran. E-mail: sattarkabiri@yahoo.com; Tel: +98-913 8862668

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Costochondral graft (CCG) is a common treatment modality for temporomandibular joint (TMJ) ankylosis. One of disadvantages of CCG is unpredictability of growth pattern and risk of overgrowth. This report illustrates management of a patient with CCG overgrowth. The patient was a girl, aged 7 years with severe facial asymmetry and TMJ ankylosis. The treatment comprised releasing of ankylotic mass and use of CCG for TMJ reconstruction. Four years later, the patient underwent overgrowth of the grafted side. Following clinical examination and scintigraphy, the grafted side was shaved to prevent more growth and the patient left to pass adolescent growth spurt. Ultimately, remnant deviation may be compensated by mild genioplasty and fat injection.

Keywords: Costochondral graft overgrowth; Ankylosis; Temporomandibular joint reconstruction

Introduction

Temporomandibular joint (TMJ) ankylosis is defined as the bony or fibrotic fusion between anatomic components of the TMJ (1). Trauma and infection have been reported as the most common causes of TMJ ankylosis (2); which subsequently could lead to pain, chewing difficulty, reduction in mouth opening and mandible deviation following restriction of normal growth of the affected side (3). This situation can pose a negative impact on psychosocial status of affected patients; therefore, early diagnosis and intervention are crucial (4).

Treatment or successful management of condylar ankylosis depends directly on history and the clinical situation of each patient. The most routine approaches include gap arthroplasty, interpositional arthroplasty and ultimately reconstruction of the joint with a graft (5). TMJ reconstruction has been used as a suitable option for young patients with limited ramus length who need further condylar growth (6). This TMJ reconstruction can be performed with various types of autogenous or alloplastic graft materials. The preferred choice in children is free CCG (7).

There are several advantages for the CCGs such as biocompatibility, free availability and potential for further growth but unfortunately there are some disadvantages, which also limit their clinical usage. The most distinct disadvantage is unpredictable growth pattern (6). In the literature, there are

confusing reports regarding growth associated with CCG. Many considered CCG as a secondary growth site, which adapts to overall transitional movements of the mandible. In contrast, some believe that CCGs have the potential to grow independently as a primary growth center (5). This unpredictable growth pattern might end up in progressive deviation towards the contralateral side of the ankylosis, following postoperative overgrowth of CCG.

The purpose of the present case report is to describe the management of CCG overgrowth following unilateral TMJ reconstruction and the treatment modality used.

Case presentation

A 7-year-old girl was referred for orthodontic and surgical consultation with severe facial asymmetry. She was healthy and did not have a remarkable medical history and had no contraindications for orthodontic and surgical treatments. Her parents reported a history of facial trauma two years ago. On clinical examination, significant chin deviation to the left and midline shift (mandibular midline shifted to the left relative to the facial midline) were apparent (Figure 1).

On functional evaluation of the patient, there was a significant restriction on full range of anterior and transverse jaw movements, with a deviation to the right on opening (her maximal mouth opening was 12 mm).



Figure 1. (A and B) Pre-treatment extra-oral photographs. M.A., aged 7 years and 3 months with a severe facial asymmetry secondary to left condyle ankylosis. Note that the deviation was apparent in chin to the left side; (C) M.A., age 11 years and 3 months with a facial asymmetry and chin deviation to the right, secondary to left condyle overgrowth. After 4 years post-costochondral graft, the patient developed overgrowth of the grafted condyle, which continued to cause deviation to the right side at rest; (D) Extra-oral photography of the patient after genioplasty. Remnant asymmetry was corrected by mild genioplasty; (E) Extraoral photography after fat injection operation. Note the improvement of facial contours

After comprehensive examination, the diagnosis was unilateral condylar ankylosis secondary to previous trauma and marked cant of upper maxillary occlusal line, which had worsened recently.

Unilateral ankylotic mass was removed with surgery and a CCG was placed in this region to reconstruct the TMJ.

In the surgical procedure, the ankylotic mass was released and the condylar structure was reconstructed using rib cartilage graft. A hybrid functional appliance was provided for the patient to maintain the surgical result. However, after 4 years, the patient experienced overgrowth of the grafted condyle, which continued into a marked deviation to the right side at rest (Figure 1C).

Treatment objective

The treatment objectives were prevention of further overgrowth, correction of mandibular deviation, improvement of facial symmetry and achievement of acceptable esthetics.

Treatment alternative

When CCG overgrowth is diagnosed, condylar shaving can prevent further unbalanced growth. Possible treatment modalities for cases with facial asymmetry due to CCG overgrowth depend on severity of deviation and its impact on the occlusal plane. When the patient exhibits occlusal cant due to maxillary or mandibular roll, bimaxillary surgery that includes Le Fort I and/or ramus osteotomy is indicated. In situations with lower severity without skeletal canting, genioplasty with or without adjunctive esthetic surgeries such as fat injection, alloplastic esthetic facial augmentation can be done.

Treatment progress

Before the operation, bone scintigraphy indicated a significant technetium uptake by the right condyle and the diagnosis of condylar hyperplasia secondary to CCG

overgrowth was made. On clinical examination, increased prominence of the outer surface of the right condyle was a sign of condylar overgrowth. After this diagnosis, it was decided to shave the right condyle to prevent overgrowth and deviation of the chin. Afterwards, we decided to let the patient pass the adolescent growth spurt and a removable appliance was inserted in order to maintain the status.

Ultimately, any remnant facial deformity would be compensated with mild genioplasty (Figures 1D and 1E). Several months after genioplasty and complete clinical examination, fat injection was performed in order to improve facial contours.

Treatment result

After genioplasty surgery, early radiographic examination via postoperative panoramic view showed significant improvement in facial symmetry. Deviation was eliminated with mild genioplasty and the facial analysis showed an acceptable improvement in facial esthetics. In the final step, fat injection improved facial contours.

Discussion

As mentioned earlier, CCG is the most common treatment of TMJ ankylosis in children due to several advantages (8, 9). The disadvantages of this method are morbidity at the donor site, poor quality and flexibility of bone which is prone to fracture, possibility of infection and the most importantly unpredictability of growth (6). Hence, the linear changes of the graft site after surgery cannot be certain (10). In most children, the grafted side grows more than the unaffected side until the two sides become equal and afterwards, the two condyles grow at the same rate; however, overgrowth of the CCG may occur in some cases (9, 11, 12).

Like the condyle, CCG is a growth site and the growth potential is under both intrinsic (hormonal effects) and extrinsic (functional matrix) control (11, 13). However, it has been suggested that over adaptive growth behavior, CCGs have the characteristics of primary growth centers (14) and germinative cartilage cells have the ability to differentiate and proliferate (5).

There is great controversy regarding the frequency of CCG overgrowth. In the study by Perrot *et al.*, 3 out of 26 patients showed signs of lateral contour overgrowth, without any changes in occlusion (10). Study by Ahmed reported 3 cases of overgrowth in 55 patients; however, in another study (TMJ reconstruction) 70% (7 out of 10) of patients had overgrowth (15). In Svensson and Adell study, 8 patients out of 12 developed asymmetry due to CCG overgrowth (16).

There are two types of overgrowth reported in the literature: lateral contour or tumor like overgrowth and linear overgrowth. The type of overgrowth in the presented patient and also the most commonly reported type in the literature is lateral contour overgrowth diagnosed by a tumor like mass on the condyle region that can push the chin towards the unaffected side causing esthetic problems and limitations in mandibular movements (10, 13, 17).

The factors that might lead to overgrowth have not been determined clearly; one of the factors that has been related to linear overgrowth of CCG is the cartilage cap size usually ranging from 0.5 to 2.5 cm (13). Large cartilage cap (1.5-2.5 cm) was suggested by some clinicians in order to prevent re-ankylosis and establish normal growth (9, 18, 19); however to the contrary other clinicians recommended a smaller cartilage cap to decrease the chance of fracture at costochondral junction and also limit the growth potential (10, 18, 19). Experimental findings of Akbay *et al.*, supported the use of smaller cartilage size (20). This patient received a CCG with 5 mm cartilage cap, and absence of any linear overgrowth supports the role of larger grafts in linear overgrowth.

Instability during function of the graft was addressed as another etiologic factor in overgrowth, suggested (10). In addition, lack of adapt ability of grafted cartilage to growth velocity of new tissue environment is another causative factor in overgrowth (21). The etiology of lateral contour overgrowth even in presence of a small cartilage cap was explained by Peltomakiet *et al.*, (21). They stated that the load-bearing condition of a new environment would lead to widening of the cartilaginous graft and also reactive enlargement in the glenoid fossa. In addition, re-attachment of the lateral pterygoid muscle and traction of fibrous capsule of the reconstructed TMJ on the graft may result in mass-like overgrowth. Furthermore, they stressed the role of hormones especially growth hormone and growth factors in regulation of CCG growth.

As previously reported by Behnia *et al.*, post-operative activator treatment can influence and guide the mandibular growth and prevent establishment of asymmetry (22). However, in this case mandibular asymmetry developed in spite of treatment with an activator. It seems that in some cases the hormonal effect may play a dominant role and overgrowth may occur even in presence of functional guidance.

Furthermore, development of malocclusion due to CCG overgrowth depends on the type of overgrowth. Many studies reported that lateral contour overgrowth is usually associated with stable occlusion (9, 10) and dental compensation may occur. However, there are few case reports of linear overgrowth of the mandible with subsequent alterations in dental occlusion (14). Other than the type of overgrowth, development of malocclusion is influenced by the severity and duration of the overgrowth, as in severe cases with long duration of growth besides the mandible, vertical maxillary growth may also be added. In this case, no specific alteration of occlusion was observed following lateral contour overgrowth of the CCG of the affected side.

There are several considerations in order to reduce the CCG overgrowth potential as follows: preservation of adequate soft tissue (temporalis muscle/fascia flap or perichondrium) between cranial base and graft, harvesting of grafts from the fourth or fifth rib that decreases the chance of overgrowth and using a small cap cartilaginous graft (12, 13). The treatment of facial asymmetry after CCG overgrowth ranges from genioplasty to bimaxillary surgery and if possible the corrective surgeries after overgrowth should be postponed until completion of growth (12).

Conflict of Interest: 'None declared'.

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