



Grafts of autogenous coronoid process to reconstruct the mandibular condyle in children with unilateral ankylosis of the temporomandibular joint: long-term effects on mandibular growth

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Abstract

Injury to the mandibular condyle in children usually leads to malocclusion and disharmony of facial growth. Our aim was to study the facial growth after reconstruction of the mandibular condyle using autogenous coronoid process grafts in children with unilateral ankylosis of the temporomandibular joint (TMJ). We followed up 10 growing patients with unilateral bony ankylosis of the TMJ who had been admitted to the West China Hospital of Stomatology, Sichuan University (Chengdu, China) between 1 January 2008 and 31 December 2012. There were three boys and seven girls, age range 5–12 years at the time of operation. In each case, patients were treated by gap arthroplasty, reconstruction of the condyle with an ipsilateral coronoid process, and interposition of the pedicled temporalis fascial flap during one operation. The mean (range) postoperative follow up was 4.73 (3–6) years. Postoperative panoramic radiographs were taken, and the growth of the mandibular height and length on the affected side was measured and compared with the healthy side. All patients had an uneventful, normal recovery. The mean (range) maximal mouth opening at the end of follow up was 35.6 (32–41) mm. Both the height of the ramus and the length of the mandible continued to grow after successful treatment of the ankylosis (using autogenous coronoid process grafts for reconstruction of the condyle) but the deficit in growth was not completely made up. The final height of the ramus on the affected side (at the end of follow up) had increased by 25% ($p=0.012$) and the final length of the mandible on the affected side by 26% ($p=0.010$) compared with immediately after operation. For comparison of the rate of growth, the increased height of the ramus of the affected side was 47% lower ($p=0.003$), while the increased length of the mandible on the affected side was 27% shorter ($p=0.008$) compared with the healthy side. The mandible on the affected side continued to grow after successful treatment of the ankylosis, but the growth deficit was not made up completely. The rate of growth of the affected mandible seemed to be less than on the undisturbed side even after treatment of the ankylosis.

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Keywords: temporomandibular joint; ankylosis; children; coronoid process; grafts; growth

Introduction

Ankylosis of the temporomandibular joint (TMJ) is an abnormal condition in which the mandible is fused to the glenoid fossa by bony or fibrotic tissues; it is commonly caused by injury or infection, and can be diagnosed by

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examination and radiographs. It interferes with mastication, speech, oral hygiene, and the development of the mandible in growing patients.¹ Treatments usually include gap arthroplasty, reconstruction of the mandibular condyle, and correction of secondary dentofacial deformities. Several techniques have been used to reconstruct the mandibular condyle² including autogenous costochondral graft,³ autogenous coronoid process,⁴ distraction osteogenesis,⁵ vertical ramus osteotomy,^{6,7} and total alloplastic joint prosthesis.⁸

The condyle is thought to be the primary centre of mandibular growth and ankylosis interferes with the development of the lower jaw. Malocclusion and disharmony of facial growth are the usual results of such damage in children. Different methods of reconstruction of the TMJ may influence further facial growth and development differently. In children a costochondral graft is the current preference for reconstruction of the TMJ, which is supposed to “grow” with them.⁹ However, results are controversial.¹⁰ The growth pattern of costochondral grafts is unpredictable,¹¹ and reports of overgrowth on the reconstructed side are common.^{12–14} Optimum growth, undergrowth, lateral growth, and no growth of the transplanted costochondral grafts have also been reported.^{15,16}

The autogenous coronoid process is another choice for reconstruction.^{4,17} Compared with costochondral grafts, it is much easier to harvest, a second donor site can be avoided, and the results of the two grafts are satisfactory and comparable.¹⁸ However, information about the growth potential and long-term fate of the transplanted coronoid process in children is limited. We describe the results of such reconstructions in 10 growing children with unilateral ankylosis. They were followed for up to eight years to evaluate the growth potential of the coronoid process at the condyle.

Patients and methods

Patients

Ten children with unilateral bony ankylosis of the TMJ were admitted to the West China Hospital of Stomatology, Sichuan University (Chengdu, China) between 1 January 2008 and 31 December 2012, evaluated, and followed up. The protocol for the study was approved by the West China Hospital of Stomatology Institutional Review Board and signed informed consent was obtained (Table 1).

Surgical technique

The operation was essentially the same for each patient. It was done under general anaesthesia with nasotracheal intubation. An equal mixture of 2% lidocaine and 1:200 000 epinephrine was injected subcutaneously along the line of the incision. We have previously described the specific procedures for gap arthroplasty and reconstruction of the TMJ.^{4,18} We exposed the ankylosed bony mass and made sure that the superficial

Table 1

Information of all patients included in this study.

Case No.	Sex	Age at operation (years)	Follow-up periods (years)	Affected side
1	Female	7	6	Left
2	Male	5	5	Left
3	Female	12	4	Left
4	Female	9	4	Right
5	Female	10	5	Right
6	Female	12	5	Left
7	Male	8	6	Left
8	Female	7	4	Right
9	Male	9	3	Right
10	Female	12	5	Right

temporal vessels and facial nerve were protected. We then completed the gap arthroplasty and created a 1.5–2 cm gap at the condylar site under the zygomatic arch to release the ankylosis. We recreated the glenoid fossa using suitably-sized burs, then placed the graft into the position of the original condyle and fixed it to the remaining ramus with plates and screws. Intermaxillary fixation was used for three weeks for every patient.

Postoperative evaluation

The patients were followed up for between 48 and 72 months after operation. Panoramic radiographs were taken immediately after operation and thereafter to assess the linear growth of the mandible. To measure the height and length of the mandible, we defined a tangent to the vertical ramus and another to the body of the mandible. The intersection point of the mandibular border and the bisector of the angle were obtained using the two crossed tangents. The distance from the intersection point to the horizontal line through the most superior point on the condyle and the vertical line through the contact point of the first incisors were defined as the height and length of the mandible separately (Fig. 1). To ensure accuracy for the quantitative analysis, we used the same apparatus for all panoramic radiographs. All measurements were made using the INFINITT PACS software (INFINITT Healthcare Co Ltd). Clinical photographs were also taken to record the maximal mouth opening and changes in the profile of the face.

Statistical analysis

Data were expressed as mean (SD) and analysed using the software package SPSS (version 17.0, SPSS, Chicago, IL, USA). The significance of differences in mandibular height and length on the affected side immediately after operation and at the end of follow up, as well as the comparison of the increased mandibular height and length of the affected and healthy sides at the end of observation time, were assessed using the paired *t* test. Probabilities of less than 0.05 were accepted as significant.

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