Int. J. Oral Maxillofac. Surg. 2018; xxx: xxx–xxx
https://doi.org/10.1016/j.ijom.2018.01.022, available online at https://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
TMJ Disorders

The sequential treatment of temporomandibular joint ankylosis with secondary deformities by distraction osteogenesis and arthroplasty or TMJ reconstruction

W. Zhang[1,a], X. Yang[2,a], Y. Zhang[1], T. Zhao[3], J. Jia[1], S. Chang[1], Y. Liu[1], Bo Yu[1], Y. Chen[1], Q. Ma[1]

[1]State Key Laboratory of Military Stomatology and National Clinical Research Centre for Oral Diseases and Shaanxi Clinical Research Centre for Oral Diseases, Department of Oral and Maxillofacial Surgery, School of Stomatology, Fourth Military Medical University, Xi'an, China; [2]Department of Orthodontics, Savaid Medical Centre, University of Chinese Academy of Sciences, Beijing, China; [3]Suzhou Dental Hospital, Suzhou, China

W. Zhang, X. Yang, Y. Zhang, T. Zhao, J. Jia, S. Chang, Y. Liu, Bo Yu, Y. Chen, Q. Ma: The sequential treatment of temporomandibular joint ankylosis with secondary deformities by distraction osteogenesis and arthroplasty or TMJ reconstruction. Int. J. Oral Maxillofac. Surg. 2018; xxx: xxx–xxx.

Abstract. The purpose of this study was to evaluate the sequential treatment of patients with temporomandibular joint (TMJ) ankylosis and secondary deformities by distraction osteogenesis and subsequent arthroplasty or TMJ reconstruction. This study included 40 patients treated at a stomatological hospital in China; they ranged in age from 9 to 53 years (mean age 24.5 years). Ten of these patients were diagnosed with unilateral TMJ ankylosis and 30 with bilateral TMJ ankylosis. Twenty-seven patients also presented obstructive sleep apnoea–hypopnoea syndrome (OSAHS). All patients underwent distraction osteogenesis as the initial surgery, followed by arthroplasty or TMJ reconstruction. Some patients underwent orthognathic surgery to improve occlusion and face shape along with or after arthroplasty or TMJ reconstruction. The therapeutic effects were evaluated in terms of the improvements in maximum inter-incisal opening (MIO), appearance, and respiratory function. After the completion of treatment, all patients showed improvements in MIO and appearance, and the symptom of snoring disappeared. The airway space was significantly increased. Patient follow-up ranged from 6 to 85 months (mean 28.3 months), and four patients experienced relapse. This study suggests that treating TMJ ankylosis with secondary deformities by distraction osteogenesis as the initial surgery and arthroplasty or TMJ reconstruction as the second-stage treatment may achieve favourable outcomes, especially for patients with OSAHS; however, some patients may require orthognathic surgery.

Key words: temporomandibular joint ankylosis; distraction osteogenesis; arthroplasty; joint reconstruction.

Accepted for publication 13 January 2018

Temporomandibular joint (TMJ) ankylosis is a serious condition that refers to adhesion of the mandibular condyle to the glenoid fossa and surrounding structures, leading to a loss of function and movement[1,2]. If TMJ ankylosis occurs

[a] Wuyang Zhang and Xuanxuan Yang contributed equally to this paper.

0901-5027/000001+08

during childhood, it may predispose patients to growth deformities, which can result in either a mandibular asymmetry deformity in unilateral TMJ ankylosis or to maxillomandibular disharmony in bilateral ankylosis. However, when TMJ ankylosis occurs in adults, it usually only results in restricted jaw opening. The typical clinical features include limited mouth opening, hypomobility of the mandible, facial asymmetry, retrogenia, micrognathia, crowded dentition, malocclusion, and even obstructive sleep apnoea–hypopnoea syndrome (OSAHS). Trauma, local or systemic infection, iatrogenic factors including previous TMJ surgery and irradiation, burns, and genetic factors may all contribute to this disease. Among all of the above factors, trauma and infection are the major pathogenetic mechanisms[3,4].

The surgical management of TMJ ankylosis accompanied by dentofacial deformities requires the restoration of facial morphology and function, along with occlusal stability and the prevention of re-ankylosis. A variety of surgical procedures have been described in the literature, including gap arthroplasty, interpositional arthroplasty, joint reconstruction using autogenous bone grafting or alloplastic materials, and orthognathic surgery. In addition, distraction osteogenesis has become increasingly popular in recent years. This technology was originally applied by Gavriil Ilizarov in the 1950s to widen or lengthen limbs. It allows lengthening of the bone and surrounding soft tissues at the same time through progressively controlled fracture separation, and it is theoretically possible to extend any distance. Furthermore, this technology may replace the use of traditional bone grafts, thereby reducing surgical trauma and avoiding functional defects at donor sites, and may decrease the risk of recurrence[6,7]. However, there is still controversy over the sequence to be used when applying distraction osteogenesis and arthroplasty to the treatment of TMJ ankylosis in patients with secondary deformities.

This study was performed to investigate the therapeutic effect of distraction osteogenesis as the first-stage treatment and arthroplasty or joint reconstruction as the second-stage treatment in 40 patients with TMJ ankylosis and secondary deformities. These patients were treated in the Department of Oral and Maxillofacial Surgery of the Stomatological Hospital of the Fourth Military Medical University during the period April 2006 to December 2014. The aim of this study was to evaluate the advantages and disadvantages of this treatment procedure.

Materials and methods

Patients

The following inclusion criteria were applied: (1) patients diagnosed with TMJ ankylosis and secondary deformities at the Department of Oral and Maxillofacial Surgery of the Stomatological Hospital of the Fourth Military Medical University between April 2006 and December 2014; (2) patients treated by distraction osteogenesis as the first stage and arthroplasty or joint reconstruction as the second stage; (3) patients with complete medical records. Patients who underwent arthroplasty or joint reconstruction first, patients with incomplete medical records, and patients whose maximum inter-incisal opening (MIO) before distraction osteogenesis was >25 mm were excluded.

Forty patients (19 male, 21 female), ranging in age from 9 to 53 years (mean 24.5 years), were selected for this study. Ten patients were diagnosed with unilateral TMJ ankylosis and 30 patients with bilateral TMJ ankylosis. Among the 40 patients, 19 (47.5%) had a history of TMJ surgery to release the ankylosis. The aetiologies included trauma ($n = 31$, 77.5%), infection ($n = 1$, 2.5%), congenital ($n = 1$, 2.5%), and unknown ($n = 7$, 17.5%, with three possibly caused by forceps injuries) (Table 1). Twenty-seven patients also presented OSAHS, which was confirmed by polysomnography examination (PSG): the OSAHS was mild in eight cases, moderate in five, and severe in 14.

The patient's medical history along with a physical examination and radiographic examination, including panoramic radiographs, cephalometric radiographs, and computed tomography (CT), are essential to determine the diagnosis and evaluate the extent of the ankylotic mass.

Treatment

Surgery for distraction device placement

The surgical approach was through a submandibular incision, for aesthetic reasons and to preserve the marginal mandibular nerve. An oscillating saw was used to mark the location of the osteotomy according to the position determined during the design and preparation phase. The buccal cortex was cut through using a bone saw, and the mandible was then sawed from the inferior margin of the mandible until there was approximately 0.5 cm between the saw and the inferior alveolar nerve canal. Next, an osteotome was used to chisel the cancellous bone and lingual cortex. The intraoral distractor was placed in the original site, and then fixed with two or three monocortical screws of approximately 6–8 mm in length on each side. The distractors were activated before wound closure in order to ensure that there was no obvious bone resistance. The activation arms were taken out from the angle of the mandible and submental region. After a 4- to 7-day latency period, activation of the distractor was initiated at a rate of 0.8–1.0 mm/day, divided into two to four intervals. The ramus distractors were activated first to obtain a length of 0.5–1.0 cm and an open bite, following which the ramus and body distractors were activated simultaneously. Once the desired position and distance had been achieved, a consolidation period of 3–6 months was applied to allow complete bone mineralization (Fig. 1).

Surgery to release the ankylosis

An extended pre-auricular incision was used to expose the TMJ region and the root of the zygomatic arch sufficiently. The ankylotic mass was totally resected. The length of the resected ankylotic mass was approximately 1–2.5 cm. The bone tips of the condyle and glenoid fossa were filed to generate a smooth bone surface. An ipsilateral and/or contralateral coronoidectomy was performed if the passive maximum opening was less than 30 mm. If the ramus height was insufficient, TMJ reconstruction was performed with the autogenous coronoid process, a costochondral graft, or a prosthesis. The distractors were also removed at the second stage, once a cortical outline could be seen on the radiographs.

Surgery for the correction of secondary deformities

Some patients required orthognathic surgery to further improve their facial profile and occlusion. If orthognathic surgery and arthroplasty are performed simultaneously, the arthroplasty may not provide good long-term stability. Therefore, orthognathic surgery should generally be performed as a third stage. However, each patient's unique needs should also be taken into consideration. Due to time constraints, some of the patients in this study had to undergo arthroplasty and orthognathic surgery simultaneously.

Please cite this article in press as: Zhang W, et al. The sequential treatment of temporomandibular joint ankylosis with secondary deformities by distraction osteogenesis and arthroplasty or TMJ reconstruction, *Int J Oral Maxillofac Surg* (2018), https://doi.org/