EurAsian Journal of Oral and Maxillofacial Surgery
Official publication of AÇBİD (Association of Oral and Maxillofacial Surgery Society)

CASE REPORT

# Patient-Fitted Total Temporomandibular Joint Prosthesis: A Case Series

**Seçil ÇUBUK,DDS,PhD, Palin ÇİFTÇİOĞLU,DDS, Burak BAYRAM,DDS,PhD,**

Oral and Maxillofacial Surgery, School of Dentistry, Baskent University, Ankara, Turkey

## Abstract

The treatment protocol of patients having end-stage temporomandibular joint (TMJ) disorder using patient-fitted TMJ prosthesis is presented in this case series. The prosthetic fossa and ramus components and the surgical guides were designed on the basis of the final position of the maxilla-mandibular skeleton using Geomagic software (Morrisville, North Carolina, USA). The prosthetic ramus component and the supporting frame of the fossa were produced using a titanium alloy. The fossa component was constructed solely from ultra-high molecular weight polyethylene. Patient-fitted TMJ prosthesis was placed through high submandibular and pre-auricular approach in 3 patients. No complication related to the operations was seen. Temporomandibular joint reconstruction using patient-fitted TMJ prosthesis resulted in satisfying jaw function and skeletal relationships in patients having end-stage TMJ disorder.

**Keywords:** temporomandibular joint; custom made prosthesis; end-stage disease

## Introduction

End-stage temporomandibular joint (TMJ) diseases can result in severe functional and cosmetic impairments. Fortunately, it is possible to reconstruct the destroyed TMJ architecture using autogenous tissue grafts or a TMJ prosthesis. However, some TMJ diseases, for example, autoimmune diseases, may adversely affect the viability of autogenous tissue grafts. Thus, a TMJ prosthesis is considered to be the most favourable treatment option for patients with such diseases.

A patient-fitted TMJ prosthesis offers an optimal anatomical fit, good anchorage and comparable biomechanical consistency. Moreover, according to the results of several long-term studies, the examined patient-fitted TMJ prostheses functioned well and were associated with only a low incidence of adverse events.[1,2]

This case series presents the treatment protocol followed for three cases whose end-stage TMJ diseases were managed using custom-made TMJ prostheses.

## Case Series

### Virtual surgical planning and manufacturing of devices

Cone-beam computed tomography (CBCT) images of each patient's craniomaxillofacial skeleton (0.75–1.25 mm slice spacing, 0.3–0.45 mm pixel size) were taken with the teeth in normal occlusion. A digital impression was acquired by scanning a previously obtained dental impression using an extraoral laboratory scanner. The DICOM (Digital Imaging and Communications in Medicine) data were segmented using OsiriX MD software (Pixmeo SARL, Geneva, Switzerland) in order to produce a virtual three-dimensional (3D) model. The scanned dental arches were aligned and a 3D cephalometric analysis performed. Osteotomies were then created on the virtual model. The prosthetic fossa and ramus components and the surgical guides were designed on the basis of the final position of the maxilla-mandibular skeleton using Geomagic software (Morrisville, North Carolina, USA). The manufacturing of all the TMJ prostheses and the surgical guides was initiated after the surgeon had approved the project. The prosthetic ramus component and the supporting frame of the fossa were produced using a titanium alloy. The fossa component was constructed solely from ultra-high molecular weight polyethylene (UHMWPE) (Fig. 1). The devices were then delivered to the hospital and stored prior to surgical placement.

### Surgical technique

All the surgeries were performed under general anaesthesia. A single dose of antibiotic (2 g cephapirin sodium) was administered intravenously. The TMJ prosthesis was inserted through high submandibular and pre-auricular approach. A coronoidectomy was performed to release the temporalis muscle. An abdominally harvested fat graft was placed around the prosthesis. All the patients were discharged on the third postoperative day.

**Corresponding Author:** Palin ÇIFTÇIOĞLU
**Address:** Department of Oral and Maxillofacial Surgery, Baskent Universitesi, Dis Hekimligi Fakultesi 82. Sok. No:26, Bahcelievler 06490 Ankara, Turkey.
**Mobile:** +90(312) 215 13 36
**E-mail:** pciftcioglu@hotmail.com

## Case 1

A 20-year-old female patient was referred to our clinic with a complaint of severe facial asymmetry. The patient's medical history revealed that she had experienced TMJ ankylosis following the malunion of a unilateral condylar fracture. A costochondral graft had been placed by another clinic in an effort to correct the facial asymmetry; however, that treatment had failed and the re-ankylosis of the joint had occurred.

The patient's maximal mouth opening (MMO) was measured as 22 mm preoperatively. Initially, orthodontic treatment was performed to achieve the alignment and decompensation of the teeth. The patient underwent a mandible-first surgical procedure. More specifically, the left TMJ was reconstructed using a patient-fitted total TMJ prosthesis. Next, sagittal split ramus osteotomy was performed on the right side in order to reposition the mandible. The patient's maxillary asymmetry was corrected by means of Le Fort I osteotomy. Her facial aesthetics were significantly improved following the procedure, although mild asymmetry remained (Fig. 1). The improvements noted in parameters such as the patient's MMO (30 mm), jaw function and TMJ pain were maintained at the end of the one-year follow-up period.

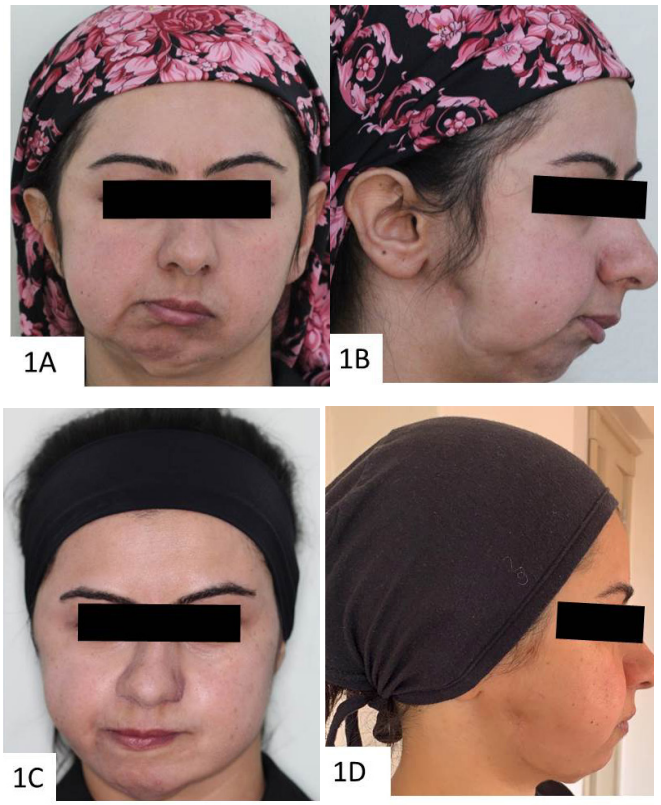


Figure 1:(A) Frontal view of the patient before surgery. (B) Facial profile of the patient before surgery. (C)Frontal view of the patient after surgery. (D)Facial profile of the patient after surgery.

## Case 2

A 39-year-old female patient who had previously undergone marsupialisation to remove keratocysts was referred to our clinic with a complaint of swelling on her left mandible. A recurrent lesion, which involved the ascending ramus and coronoid process, was observed on the patient's CBCT imaging results.

The lesion was enucleated and coronoidectomy was performed as the first intervention at our clinic. However, the recurrence of the lesion was noted during the three-year follow-up session. Therefore, resection of the left ramus mandible and reconstruction using a total TMJ prosthesis were performed. No pain or signs of infection were observed at the end of the six-month follow-up period after this second intervention (Fig. 2).

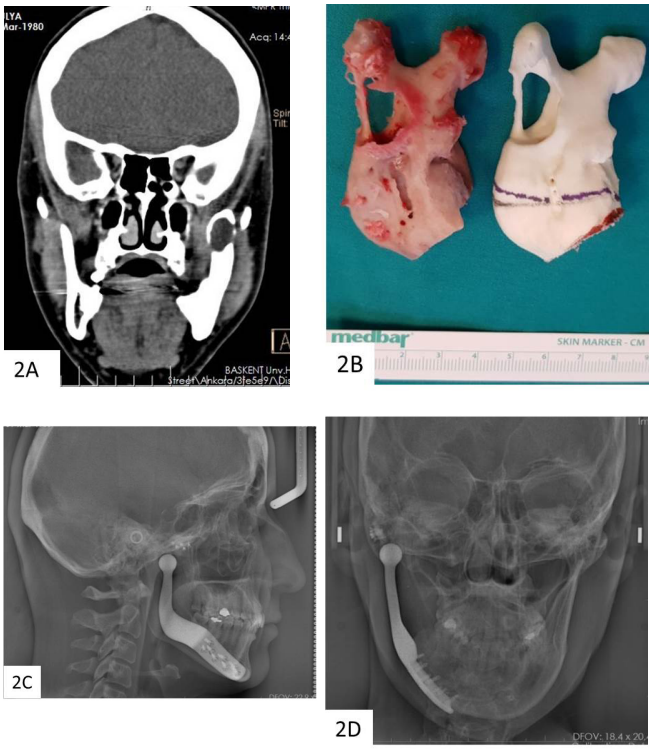


Figure 2:(A) CT imaging of the patient having recurrent keratocysts.(B) Resection of condyle and ramus was performed in accordance with the 3D surgical planning. (C) Lateral cephalometric radiograph of the patient after surgery. (D) Anteroposterior radiograph of the patient after surgery.

## Case 3

A 32-year-old female patient was referred to our clinic with a complaint of severe mandibular retrusion. She presented with oligoarticular juvenile idiopathic arthritis (JIA). Moreover, her CBCT imaging results revealed class II skeletal deformity and flattened bilateral condylar heads.

The patient began orthodontic treatment in preparation for the surgery. Her MMO was recorded as 34 mm preoperatively. Mandibular advancement was achieved by means of TMJ reconstruction using a TMJ prosthesis. Six months after the first intervention, genioplasty was also performed. The

patient's postoperative MMO was measured as 34 mm. In addition, a balanced facial profile was obtained (Fig. 3).


Figure 3:(A) Facial profile of the patient before surgery. (B) Facial profile of the patient after surgery.

## Discussion

Alloplastic TMJ prostheses can be used for the treatment of various TMJ conditions, including congenital disorders of the TMJ, degenerative joint diseases, ankylosis and failed TMJ surgeries. Patients who have received custom-made prostheses report less TMJ pain, improved jaw function, increased ability to eat solid food and improved quality of life at the 20-year follow-up point.[2]

Unilateral condylar injury during childhood may cause both functional disorders and facial asymmetry. Superior impaction of the fractured condylar neck usually occurs when the displaced condylar head is not properly returned to its original position, which results in the shortening of the ramus. The use of a costochondral graft for TMJ replacement is generally accepted as the ideal treatment method in children.[3] However, a number of complications, such as pneumothorax, ankylosis and the overgrowth of the graft, may develop.[4,5] In addition, a previous study reported that the resorption of the costochondral graft occurred in 25% of patients.[4] The post-traumatic TMJ deformity of the patient referred to as Case 1 in the present case series was reconstructed using a costochondral graft during childhood. However, the graft developed an undergrowth, which meant that severe facial asymmetry could still be observed in the patient. A patient-fitted TMJ prosthesis was chosen as the treatment method for correcting the facial asymmetry seen in this patient, as such an approach is known to be associated with more predictable results in patients who have undergone multiple surgeries.2 In fact, the facial asymmetry was substantially corrected in this patient, while the outcomes remained stable during the four-year follow-up period.

Patients with JIA may exhibit TMJ involvement, which can result in dentofacial deformities. Both solely orthognathic surgery and orthognathic surgery concurrent with TMJ replacement can be considered viable treatment methods depending on the severity of the deformity. Prior studies have indicated that the immunosuppressant therapies used for the treatment of JIA may increase the risk of developing an infection following the placement of the prosthesis.[6,7] However, the actual influence of immunosuppressant therapies on the development of infection after the placement of a TMJ prosthesis remains unclear. No signs of infection were seen in the patient with JIR (i.e. Case 3) featured in this case series.

As a conclusion, patient- fitted TMJ prosthesis allowed for large and extremely stable mandibular advancements and substantial increase in posterior facial height to obtain facial symmetry and balanced facial profile.

## References

1. Aagaard, E., & Thygesen, T. (2014). A prospective, single-centre study on patient outcomes following temporomandibular joint replacement using a custom-made Biomet TMJ prosthesis. International journal of oral and maxillofacial surgery, 43(10), 1229-1235.
2. Wolford, L. M., Mercuri, L. G., Schneiderman, E. D., Movahed, R., & Allen, W. (2015). Twenty-year follow-up study on a patient-fitted temporomandibular joint prosthesis: the Techmedica/TMJ Concepts device. Journal of Oral and Maxillofacial Surgery, 73(5), 952-960.
3. Lee, W. Y, Park, Y. W., & Kim, S. G. (2014). Comparison of costochondral graft and customized total joint reconstruction for treatments of temporomandibular joint replacement. Maxillofacial plastic and reconstructive surgery, 36(4), 135.
4. Medra, A. M. (2005). Follow up of mandibular costochondral grafts after release of ankylosis of the temporomandibular joints. British Journal of Oral and Maxillofacial Surgery, 43(2), 118-122.
5. Villanueva Alcojol, L., Monje Gil, F., González García, R., Moreno García, C., Serrano Gil, H., Maestre Rodríguez, Ó., ... & Mateo Arias, J. (2009). Costochondral graft with green-stick fracture used in reconstruction of the mandibular condyle: experience in 13 clinical cases.
6. McLean-Tooke, A., Aldridge, C., Waugh, S., Spickett, G. P., & Kay, L. (2009). Methotrexate, rheumatoid arthritis and infection risk-what is the evidence?. Rheumatology, 48(8), 867-871.
7. Scherrer, C. B., Mannion, A. F., Kyburz, D., Vogt, M., & Kramers-de Quervain, I. A. (2013). Infection risk after orthopedic surgery in patients with inflammatory rheumatic diseases treated with immunosuppressive drugs. Arthritis care & research, 65(12), 2032-2040.