

Selective Embolization for Total Replacement of the Temporomandibular Joint in Advanced TMJ Ankylosis

► Surgeons with the Department of Oral and Maxillofacial Surgery at Penn Medicine are using a protocol with Penn Interventional Neuroradiologists to prevent massive blood loss during total replacement of the temporomandibular (TMJ) joint in advanced ankylosis.

TMJ ankylosis is a functional disorder of the mandible that presents as varying degrees of limited jaw opening. In this condition, the lower jaw fuses with the skull base. The degree of bone fusion can range from moderate condylar impairment with fibrous attachments, or massive bony fusion between the condyle and fossa at the skullbase with near absent mobility. If untreated, ankylosis of the TMJ can lead to progressive debility, limitation of mouth opening, mandible deformity, malocclusion and persistent lockjaw. Ankylosis can also interfere with intubation during surgery.

Correction of advanced TMJ ankylosis involves surgery with the objective of removing the ankylotic bony mass and restoring function to the joint. Of particular concern is the surgeon's inability to access the internal maxillary artery beneath the ankylotic mass. Compromise of the vessel at surgery presents the possibility of unmanageable hemorrhage. Postoperative heterotopic bone formation and reankylosis at the original site of surgery can also be troublesome.

Penn Oral and Maxillofacial Surgery has assumed a leading role in addressing these concerns, not only as a major contributor to the development of the Biomet® Microfixation Total Mandibular Joint (TMJ) Replacement System, but as a proponent of a multispecialty team approach to optimize patient outcomes.

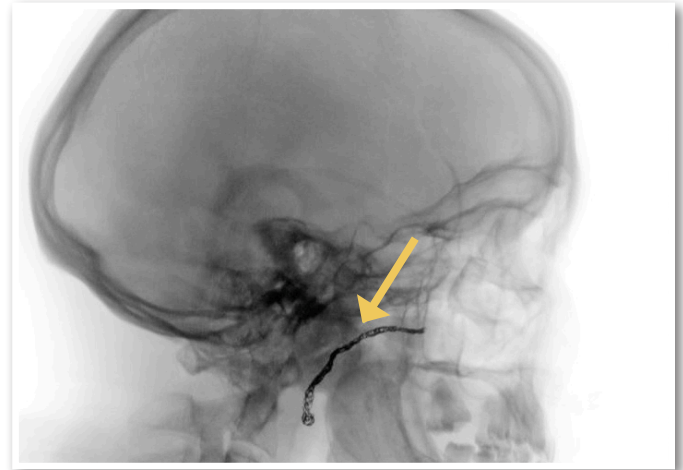
To prevent potentially massive hemorrhage, Penn Interventional Neuroradiology selectively embolizes arteries around the ankylotic mass prior to surgery, permitting the surgical team to remove bone as needed to obtain their objectives.

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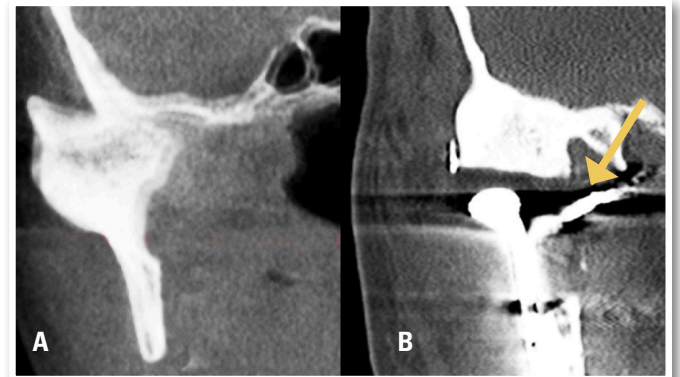
CASE STUDY

Mr. W, a 51-year-old man, was referred to Penn Oral and Maxillofacial Surgery for an evaluation of longstanding inability to move his jaw. He had previously had a gap arthroplasty of his right TMJ, which had subsequently re-fused. At Penn, Mr. W had an initial maximal mouth opening of 2mm, along with difficulties with speaking.

Following a CT angiogram, massive ankylosis was evident along with intimate involvement of the internal maxillary artery. Virtual surgical planning was performed in order to design the bone cuts to ensure adequate bone removal along with avoidance of the middle cranial fossa, external auditory canal, and inferior alveolar nerve. Custom printed cutting guides were manufactured to ensure recapitulation of the surgical plan in the operating room.



► **Figure 1:** Post-procedure film demonstrating successful embolization of the internal Maxillary artery medial to the ankylotic mass (arrow).



► **Figure 2:** **A.** Preoperative coronal CT showing massive TMJ ankylosis and fusion of the mandible to the skull base. **B.** Postoperative coronal CT following ankylosis resection and immediate temporomandibular joint replacement. Note arrow showing the embolized internal maxillary artery.

The day before surgery, Mr. W had a percutaneous embolization procedure on his left internal maxillary artery under continuous fluoroscopic guidance, with post-embolization angiography demonstrating exclusion of the artery at a segment medial and deep to the ramus of the mandible (Figure 1).

At his scheduled surgery, the bone resection occurred as planned and a stock TMJ Biomet prosthesis was placed (Figure 2B). Mr. W started immediate function using the TMJ enhanced recovery after surgery (ERAS) protocol and was discharged the following day. At his one year follow-up, Mr. W had a functional opening of 30 mm and was maintaining a normal diet.

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Increasing the excised bone or “gap” can help minimize recurrence. In addition to this multidisciplinary approach, virtual surgical planning is used to design and implement patient patched cutting guides to ensure outcomes. This presurgical planning aids in preventing complications during surgery including ear injury and dural exposure.

For patients with advanced TMJ ankylosis, treatment at Penn Medicine begins 24 hours prior to surgery when the internal maxillary artery is embolized under fluoroscopic guidance. Next-day surgery involves gap arthroplasty — a procedure that removes the bony fusion and residual condylar head to create a 15–20 mm gap in the bone — combined with implantation of the total TMJ replacement system. The bone gap is then filled with an autogenous abdominal fat graft to prevent reankylosis.

After surgery, patients at Penn Oral and Maxillofacial Surgery enter the Enhanced Recovery After Surgery (ERAS) program, a protocol that has the goal of improving the postoperative experience and advancing the safety of TMJ ankylosis patients.

In addition to oral and maxillofacial surgeons and neurointerventional radiologists, achieving successful TMJ replacement at Penn requires care from pain specialists, internists, physical therapists and general dentists to optimize patient outcome.

FACULTY TEAM

The faculty at Penn Oral and Maxillofacial Surgery includes internationally known surgeons and pioneers in TMJ surgery. Penn surgeons have extensive experience in treating conditions involving the temporomandibular joint, including complex joint and combined jaw surgeries, and see one of the highest volumes of joint surgery in the country.

The mission of the Penn Center for Temporomandibular Joint Disease at the Department of Oral and Maxillofacial Surgery is to advance the understanding and treatment of temporomandibular joint disease. Finding the source of the pain to define the etiology of TMJ is one of the Center’s key services.

In addition to practical evaluations, diagnostic tools include Panorex, MRI and CT imaging. Treatment at the Center is directed at the origin of pain. The first-line therapy for TMJ disorders is short-term conservative management. Patients who continue to have symptoms of TMJ disease or progression despite optimal conservative management may benefit from interventional therapy.

► Performing Surgery for Advanced TMJ Ankylosis at Penn Medicine

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