

New Technologies to Improve Outcomes in Facial Deformities caused by TMJ Disease

Surgeons at the Penn Center for Temporomandibular Joint Disease are performing combined temporomandibular joint total joint replacement (TMR) and orthognathic surgeries (jaw surgery) to correct coexisting TMJ and facial deformities. Combining these procedures allows surgeons to optimize jaw movement and improve long-term stability by treating the diseased TMJ. This has the potential to substantially improve outcomes by addressing TMJ pain and dysfunction while improving quality of life through improved airway patency (obstructive sleep apnea), mastication (eating) and facial aesthetics.

Pathologies of the TMJ may result in the poor orthognathic (jaw) position and lower facial deformities, especially during facial development. TMJ disease in childhood may occur from juvenile arthritis, facial trauma, or infection. Later in life, TMJ disorders may manifest as TMJ clicking and/or limited opening (trismus), chronic pain, sleep apnea, malocclusion (underbite), dysphagia and dysarthria. Cosmetic concerns and issues of social interaction are also common.

Formerly, surgeries to correct deformities of the TMJ and jaws were addressed separately by necessity, or jaw movements were minimized to decrease the strain on the jaw. Relapse, or movement of the jaws back to their original position also may occur if the TMJ disease is not adequately addressed.

Several recent technological advances, now used together, have allowed surgeons to perform complex surgeries simultaneously, optimizing outcomes. Such new advances include: progress in presurgical planning (particularly innovations in virtual surgical modeling and preplanning technology), the introduction of custom device (patient specific), custom surgical guides, and intra-operative imaging (ensuring correct device placement). These technologies, used together, can allow for improved surgical proficiency. The team at the **Penn Center for TMJ Disease** continues to lead in the use of these technologies in complex TMJ surgery reconstruction.

Depending upon the extent and nature of the deformities involved, corrective surgeries may include condylectomy, coronoidectomy, maxillary osteotomy, and genioplasty. The success of these procedures in combination is greatly enhanced by the availability of custom-fitted total joint prostheses for TMJ reconstruction and virtual surgical planning. The latter involves stereolithographic 3D printed models and custom surgical templates created from computer-generated simulations. Surgeons also employ intra-operative CT imaging to confirm accurate placement of custom devices. This combined use of technology and high-volume experience allows surgeons to achieve optimal function, facial harmony, occlusion, and oropharyngeal airway dimensions at surgery.

CASE STUDY

Mrs. M, a 25-year-old female, traveled out of state on referral to Eric Granquist, DMD, MD, at the Penn Center for Temporomandibular Joint Disease, with a history of juvenile idiopathic arthritis (JIA) and resultant lower facial asymmetry. At presentation, Mrs. M displayed a severe TMJ breakdown and deformity (undergrowth) of her upper and lower jaw (Fig.1). Despite her JIA being otherwise under control, her TMJ continued to cause pain, limited opening, speech, swallowing and cosmetic concerns.

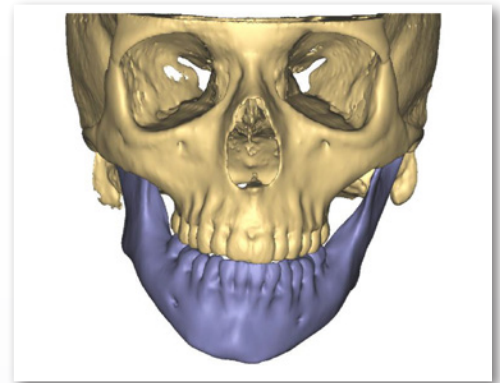


Figure 1: Pre-operative 3D CT image demonstrating poor orthognathic position and lower facial deformities as a result of juvenile idiopathic arthritis with concomitant maxillary and temporomandibular joint deformity.

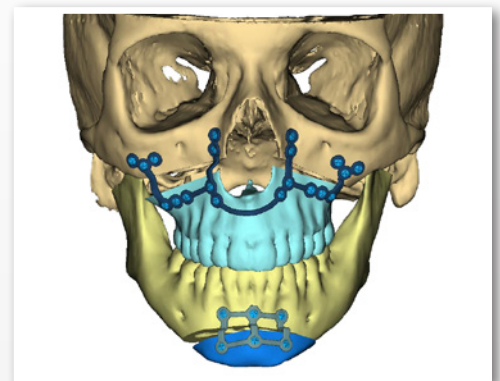


Figure 2: Virtual surgical planning for surgeries to realign lower jaw and chin and for TMJ replacement.



Figure 3: Post-surgical image with TMJ replacement (arrows) and successful maxillary and mandibular realignment.

Continued on back



Combination TMJ/orthognathic surgeries involve comprehensive virtual surgical planning to visualize the surgical process prior to the procedure. Custom surgical guides are then made as surgical aids to ensure accurate bone cuts and movements. Intra-operative CT is used to confirm appropriate TMJ replacement hardware before the surgery is completed.

CASE STUDY *(Continued)*

After a consultation involving a thorough review of her options, Mrs. M chose to have combined TMJ/orthognathic surgeries. Her surgeries were then planned using virtual surgical planning software (VSP) to optimize her jaw position, and identify areas of bone interference (Fig 2). Patient-specific bone hardware and joint prostheses were then manufactured prior to surgery.

The VSP allowed Dr. Granquist to see the surgical movements prior to surgery to ensure that Mrs. M's concerns were addressed. Custom surgical guides were made to aid the surgeons to ensure accurate bone cuts and movements. Finally, Penn surgeons employed intra-operative CT to confirm appropriate TMJ replacement hardware before the surgery was completed.

During surgery, Mrs. M had a series of surgeries to realign her lower jaw and chin including Lefort I osteotomy (upper jaw), TMJ replacement (lower jaw) and genioplasty (chin) (Fig 3). She remained in the hospital for one day following surgery, and at her six-month follow-up reported substantial improvements in almost every category of quality of life.

FACULTY TEAM

The mission of the Penn Center for Temporomandibular Joint Disease at the Department of Oral & 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 Combined Surgeries for TMJ Disease and Orthognathic Deformities at Penn Medicine

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