



Surgical Wonders for Challenging Patients: Minimally Invasive TMJ Surgery

Introduction

Temporomandibular disorder (TMD) is a collective term embracing a number of clinical problems involving the musculature and temporomandibular joint (TMJ).¹ The TMD classification consists of meniscal internal derangements, ligament disorders, synovial abnormalities, articular cartilage pathology, adhesions and muscular abnormalities. The pathology of intracapsular TMDs is initiated by one or more events: acute microtrauma (prolonged dental procedures, laryngoscopy); chronic microtrauma (MPD, chronic bruxism, clenching, muscle spasm); acute macrotrauma (motor vehicle accidents, mandibular fracture, whiplash injury, etc.); chronic macrotrauma (chronic jaw subluxation, osteoarthritis); pharmacologic (mandibular dyskinesia from major tranquilizers).^{5, 6}

Temporomandibular joint arthroscopic surgery for the treatment of intracapsular disorders is performed through 2.3 mm portals as an outpatient procedure. In this article specific indications, diagnostic imaging and prior medical management will be reviewed. Arthroscopic technique and pathology outcome will be illustrated. TMJ minimally invasive surgery is a reliable and valuable option in treating patients with long standing temporomandibular joint disorders who have been refractory to conservative, non-invasive treatment.^{2,3}

TMD Signs and Symptoms

A thorough history is paramount in determining the diagnosis of TMD facial pain. The history is composed mainly of questions about pain, jaw dysfunction, joint noise, swelling (numbness), headache, tinnitus and other reasons for the chief complaint. Pre-auricular pain should be addressed as far as onset, location, frequency, aggravating and palliative factors. Pre-auricular pain may radiate or be localized and is usually dull or throbbing. If the intensity is increased the pain may be sharp and stabbing during mandibular function, such as eating and talking. The intensity of the pain is assessed using an imaginary and subjective visual analogue scale (VAS) from 1 (mild) to 10 (severe). Pre-auricular pain may be localized but often will radiate to the ear, temple, mandible, retro-orbital region and sternomastoid muscle region.

Patients sometimes will report headache that is unilateral or bilateral and generally over the muscles of mastication. They may note that their TMD will increase the frequency of migraine headache. Occasionally patients will have tinnitus or ringing in the ear. Approximately five percent of patients with TMJ inflammation may have tinnitus. It is important to rule out other possible sources of pain such as pulpitis, abscess, cyst formation, pathology, oral infection and pericoronitis. Other headaches, neck aches, earaches, sinusitis, or shoulder pain should also be noted.

Mandibular Function

Jaw dysfunction should be assessed with regards to locking, dislocation, limited opening or masticatory dysfunction. Limited opening or “closed lock” is a feature of TMD. This is where the vertical dimension (incisor to incisor) is limited and should be normally 40 to 60 mm on average.¹ The right and left lateral excursions are not symmetrical and are not 25 percent of the normal vertical opening. Protrusion also shows a deviation to the affected side. Limited opening is less than 40 mm.

Joint noises such as clicking, popping or crunching occur in 30 to 40 percent of the population normally. **These noises are not significant if there is no accompanying history of pain or limited jaw movement.** Twenty percent of patients with a click may progress to a closed lock after subsequent trauma. Swelling is rare to see but occasionally will occur with infection such as septic TMJ arthritis. This can cause posterior open bite on the affected side. Swelling may also represent an effusion (collection of inflammatory fluid) in the joint space causing posterior open bite.

Conservative Treatment

Conservative treatment is usually offered as a first line for patients with the above complaints. This is in the form of physiotherapy, such as jaw stretches, ultrasound, transcutaneous electrical nerve stimulation (TENS), iontophoresis/phonophoresis, cold laser, moist and dry heat compresses. This may be augmented with splint therapy in the mandibular or maxillary arches. Pharmacotherapy usually consists of non-steroidal anti-inflammatory drugs (NSAIDS) which are found to be best for TMJ inflammation. Other forms of conservative therapy include biofeedback and stress management.

Diagnostic Imaging

Diagnostic imaging is indicated when patients have no benefit from conservative therapy, for medico-legal reasons, or to help in diagnosing the degree or severity of internal derangement. Table 1 lists the types of diagnostic imaging currently used for TMDs.

Table 1.
Diagnostic Imaging

1. Panorax is best as a “scout” film
2. Arthrotomography
3. CAT scan (good for ankylosis)
4. MRI T1 and T2 weighted images, Gadolinium enhanced T1
5. Skeletal Scintigraphy—Tech 99 bone scan (for infection) or increased bone turnover

Magnetic Resonance Imaging (MRI) is the primary diagnostic test used currently. Table 2 lists the indications for ordering an MRI.

Table 2.
Indications for an MRI

1. Pain-dysfunction refractory to non-surgical therapy
2. Positive prolonged history of locking
3. Limited opening of indeterminate origin
4. Patient prefers to see what is wrong
5. Medico-legal reasons (MVA)
6. MRI shows false negative displacements

The MRI will reveal the position and morphology of the disc and effusion (inflammatory exudate) if T2 weighted images are ordered, joint mice (loose cartilage) and occasionally tears in the discs. It will also determine degenerative arthritic changes. The Gadolinium Enhanced MRIs will reveal, if present, a marked thickening inflammatory synovium, intra-articular effusion corresponding to synovitis and morphology of the disc.

Diagnostic and Surgical Arthroscopy

The indications for diagnostic operative arthroscopy are summarized in Tables 3 and 4 respectively.

Table 3.
Indications for Diagnostic Arthroscopy

1. Unexplained persistent TMJ pain
2. Need for biopsy
3. Confirmation or enhancement of other diagnostic findings
4. Supplement arthrotomy
5. Confirm the presence of fibrous intact barrier after removal of an implant
6. To determine the position of the disc in patients where MRI and Arthrograms are contraindicated as in patients with severe anxiety or allergy to IVP dye or shellfish.

Table 4.
Indications for Surgical Arthroscopy

1. Persistent pain
2. Acute and chronic closed lock
3. Internal derangement of the disc
4. Synovitis
5. Degenerative joint disease (osteoarthritis)
6. Hypomobility
7. Hypermobility
8. Evacuation of hematoma
9. Infections—I&D, Culture and Sensitivity, Gram Stain
10. Biopsy
11. Removal of adhesions/ joint mice

continued page 24



Figure 1.
Arthroscopic Monitor, light source and
Polaroid camera.



Figure 2.
Arthroscope and hand instruments,
canulas and trocars.



Figure 3.
Arthroscopic shaver.

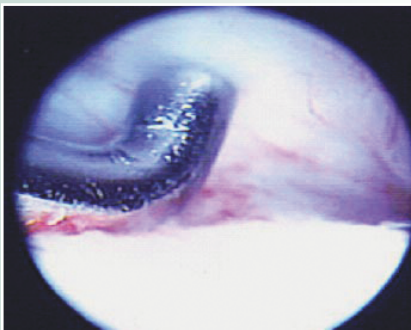


Figure 4.
Grade 1 chondromalacia (articular
cartilage; notice dimpling with probe)

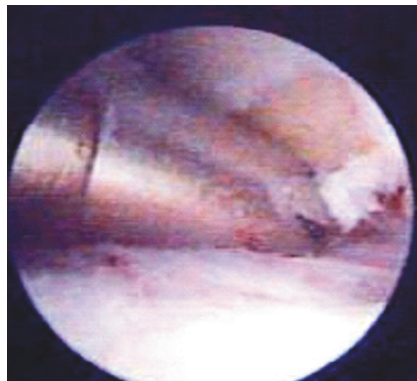


Figure 5.
Grade IV chondromalacia (notice
bone exposure)

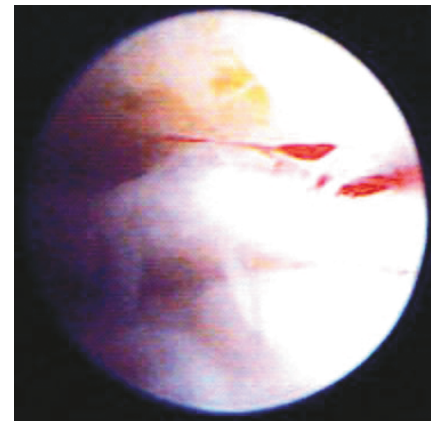


Figure 6.
Disc perforation (notice adhesions in
lower joint space)

The contraindications to arthroscopy are: adjacent infection (ear); risk of tumor seeding; non-palpable pre-auricular depression; altered zygomatic arch, fossa-eminence from previous surgery (ENT); other anatomical or medical contraindications. Figures 1, 2 and 3 reveal the arthroscopic armamentarium required for the procedures.

Arthroscopic Procedures and Arthroscopic Surgery

The advantages of arthroscopy are as follows: outpatient day surgery; minimal time off work; rapid recovery rate (three days to one week); no visible scar and an OHIP-positive procedure. The procedure is performed using 2.3 mm canulas with advanced fiberoptic instruments. Table 5 lists the various procedures used to address the pathology seen.

Table 5.
Surgical Arthroscopic Procedures

- | | |
|-----------|---|
| 1. | Lavage of joint space (removal of mediators of inflammation and joint debris) |
| 2. | Adhesiolysis of adhesions |
| 3. | Lateral Capsular release |
| 4. | Abrasion Arthroplasty |
| 5. | Synovectomy (partial and total) |
| 6. | Subsynovial steroid injection |

Arthroscopic Pathology

1. Chondromalacia

Chondromalacia is articular cartilage degeneration. This may occur as softening, blistering, fibrillation and ulceration. Crater formation is Grade IV with bone exposure. Chondromalacia can occur with stress bruxism resulting in chronic microtrauma with compression and shearing occurring, causing chondrocyte damage and release of collagenases, cathepsins, leukotrienes and prostaglandins. These enzymes cause a splitting of proteoglycan chains as well as water loss in the cartilage, resulting in a loss of cartilage resilience and water reabsorption.^{4,5} Figure 4 reveals chondromalacia of the articular cartilage (Grade I) which is viewed as a dimpling of the cartilage diagnosed with a

curved probe. In Grade II chondromalacia is cartilage blistering. Figure 5 reveals Grade IV chondromalacia with exposure of bone. Notice that the shaver is removing degenerated cartilage around the area of cartilage loss. Figure 6 shows a disc perforation. Notice Grade IV chondromalacia on the superior surface of the temporal bone as well as cartilage loss on the anterior portion of the condylar head with adhesion formation in between.

2. Synovitis

Inflammation of the synovial membrane is known as synovitis. Synovitis consists of hyperemia, hypervascularity and hyperplasia. There may also be petechial hemorrhaging of the medial wall of the temporomandibular joint capsule. There can also be creeping synovitis which is synovium that migrates over normal disc in response to aggravating factors. Figure 7 reveals severe synovitis in posterior attachment tissues with hypervascularity. Notice the oblique protruberance and disc inferiorly. Figure 8 shows petechial hemorrhaging particularly in the medial wall. Figure 9 reveals hyperemia of the blood vessels in the posterior band and attachment. Notice the posterior band on the left side of this figure. Figure 9 shows vascular engorgement (hyperemia). Figure 10 shows severe posterior attachment synovial hyperplasia. Synovectomy is illustrated.

One of the plausible mechanisms of severe TMJ inflammation/synovitis is stress leading to increased bruxism, TMJ overloading (microtrauma) which causes articular collagen fibrillar degeneration with particles of degenerating proteins affecting the synovial membrane causing release of arachidonic acid, prostaglandin E2, leukotrienes B4 and others, leading to synovitis. Figure 11 shows synovial chondromatosis with the presence of cartilaginous particles within the joint spaces. Other causes are related to direct trauma to the TMJ via blunt forces such as assaults and sports injuries.

3. Adhesions

Adhesions limit disc mobility and function. Adhesions cause increased pain by the process of stretching the periosteal membrane leading to limited jaw opening. Figures 12 and 13 illustrate lysis of the adhesions using hand instruments. Graspers were also used to debride the joint. Figure 14 reveals an adhesion which is excised with small graspers. (Notice the disc below and relief of subsequent tension). Figure 15 shows an abrasion arthroplasty and Figure 16 reveals subsynovial steroid injection.^{5,6,7,8}

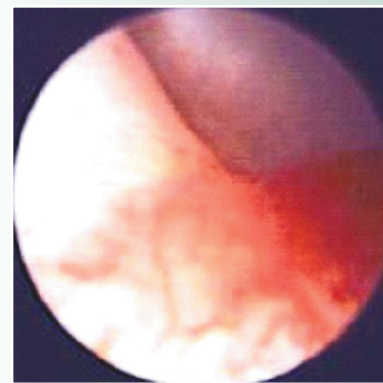


Figure 9.
Hyperemia of blood vessels
(posterior band and attachment)

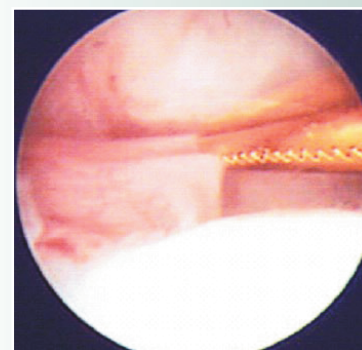


Figure 10.
Severe synovial hyperplasia
(synovectomy)

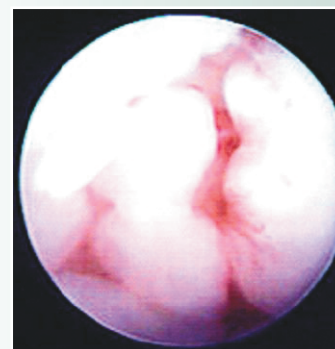


Figure 11.
Synovial chondromatosis (notice
particles of cartilage in joint space)



Figure 7.
Severe posterior attachment synovitis
with hypervascularity

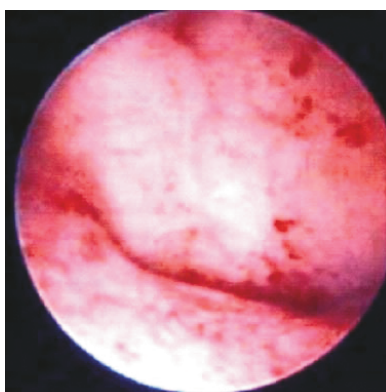


Figure 8.
Petechial hemorrhaging (medial wall)

continued page 26

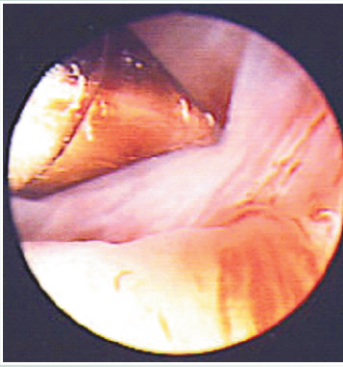


Figure 12.
Lysis of adhesions (with hand instrument)



Figure 13.
Adhesion cut with scissors



Figure 14.
Adhesion excised with graspers

4. Degenerative Arthritis (Osteoarthritis)

Degenerative arthritis is evident when one or more arthroscopic findings are present:

- a) Fibrillation of fibrocartilage and disc
- b) Exposure of subchondral bone
- c) Eburnation of subchondral bone
- d) Disc perforation

Often numerous fibrous adhesions and mild vascularity on articular surfaces may be evident arthroscopically.

Summary

Positive results are usually attained within three weeks of arthroscopic surgery. Patients will open 40 mm or more and note a significant decrease in pain.^{7,8} They will use fewer analgesics and medicines and are often more cheerful, upbeat and appear to be enjoying a better quality of life.

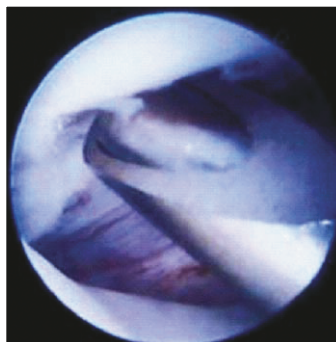


Figure 15.
Abrasion Arthroplasty

TMJ arthroscopy is a useful technique requiring scheduled patient follow-ups. It reveals significant diagnostic information about specific TMDs. The surgical procedures used are minimally invasive to the patient and yield significant benefits to them. It has become the "gold standard" for initial TMJ surgical intervention. 

Dr. Kryshtalskyj is a 1983 graduate of the Faculty of Dentistry, University of Toronto. He is currently the Chief, Division of Oral and Maxillofacial Surgery & Dentistry at the Trillium Health Centre in Toronto. Dr. Kryshtalskyj also maintains a private practice in Toronto and may be reached at 416-760-0606.

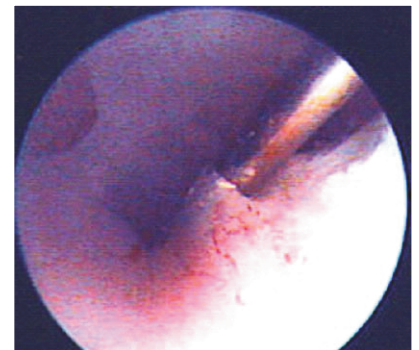


Figure 16.
Subsynovial steroid injection (notice needle in posterior attachment)

References

1. Laskin, D.M., Greene, C.C., Hylander, W.L. *TMDs – An Evidence-Based Approach to Diagnosis and Treatment*. Quintessence Publishing. Co. Inc. VIII – IX, 16, 2006.
2. Tarro, A.W. *TMJ Arthroscopy Diagnostic and Surgical Atlas*, J.B. Lipincott Co. 89-115, 1993.
3. McCain, J.P. *Principles and Practice of Temporomandibular Joint Arthroscopy*, Mosby. 62 – 101, 1996.
4. Quinn, J.H. *Pathogenesis of TMJ Chondromalacia and Arthralgia*. *Oral Maxillofacial Surgery Clinic North America*, 1:1, 56, 1989.
5. Kryshtalskyj, B. *The Journal of Otolaryngology*, 325-328, 20:5, 1991.
6. Kryshtalskyj, B., Weinberg, S., *Surgical Correction of Internal Derangement of the TMJ; the state of the art*. *Oral Health*, 19-36, 78, 1988.
7. Montgomery, M.T., Van Sickels, J.E., Harms, S.E., Thrash, N.J., *Arthroscopic TMJ Surgery*. *J. Oral Maxillofacial Surgery* 47:1267 – 1271, 1989.
8. Mosby, E.L., *Efficacy of Temporomandibular Joint Arthroscopy: A Retrospective Study*. *J. Oral Maxillofacial Surgery*, 51:17-21, 1993.s