

Surgery of the Temporomandibular Joint

Overview

1. Indications for surgery
2. Surgical anatomy
3. Treatment
4. Complications
5. Physiotherapy

1. Indications for surgery

1. Internal joint derangement
2. Degenerative joint disease
3. Condylar Hyperplasia
4. Recurrent dislocation
5. Trauma
6. Ankylosis

2. Surgical anatomy

1. Skin incision

- i preauricular
- ii temporal extension - improves access & reduces facial nerve traction
- iii cervical extension - for OFIF of fractured condyle & costochondral grafts
- iv postauricular - ? better cosmesis and access to posterior joint but longer operating time

2. **Temporal fascia:** from superior temporal line to zygomatic arch - splits into 2 layers 2cm above zygomatic arch superficial to lateral arch & deep to medial arch.

3. **Facial Nerve:** temporal & zygomatic branches cross zygomatic arch from 0.8 - 3.5 cm anterior to anterior concavity of external auditory canal. Where they cross the arch they lie in tight condensation of periosteum and temporalis fascia. To minimise risk of damage to nerves approach arch from above at level of superficial temporalis fascia. Incise at 45 degrees 2 cm above arch and enter split between fascial layers containing fat, zygomatic branch of superficial temporal artery & zygomaticotemporal branch of maxillary nerve. From within

pocket created blunt dissection down onto arch & incise periosteum on top of arch from within pocket. Reflect periosteum & superficial fascia outwards as one layer. Facial nerve branches will lie above this layer.

4. **Parotid salivary gland:** between mastoid and posterior border of mandible extends to overlies masseter superficially. Extends deep to mandible and upper part of deep lobe (glenoid lobe) lies behind TMJ in contact with external auditory meatus. Deep lobe separated from superficial lobe by facial nerve branches lies medial to mandible below glenoid lobe and lying on internal jugular vein contains retromandibular vein & maxillary artery
5. **Joint capsule & ligaments:** capsule from articular eminence & squamotympanic fissure above to neck of condyle below. Reinforced by temporomandibular ligament from lower border of zygoma above passing down and back to posterior border of neck and ramus of mandible below.
6. **Joint meniscus:** attached around periphery to inside of capsule - posteriorly attached to squamotympanic fissure, medially & laterally to poles of condyle and anteriorly merges into superior head of lateral pterygoid muscle.

3. Treatment

1. Internal derangement

Definition: Anterior or anteromedial displacement of the articular disc when the teeth are in the centric (intercuspal) position.

Usually applied in cases where there are changes in the disc:condyle relationship. The displaced disc produces pain, hypo mobility and reduced function. Must distinguish true internal derangement from more common condition of myofascial pain dysfunction syndrome. May coexist but need to tailor treatment accordingly.

As this is the commonest reason for operating on the TMJ majority of time will be devoted to its aetiology and treatment.

Prevalence: 11.6% - 56%. Increases with age of population studied. More common in females than males.

Pathophysiology: Over 400 articles published last year on TMJ disorders. No other joint in body has been investigated so much and we still do not know the exact cause of TMJ diseases. Basic problem is disruption of normal disc to condyle relationship due to weakening or rupture of disc attachments to condyle or base of skull.

Embryologically the disc is derived from the superior lateral pterygoid tendon which passes over the condylar cartilage to be inserted into Meckel's cartilage. In new-born all

articulating surfaces are covered by synovial membrane. With wear this comes to line capsule only.

The mature articular disc is composed of dense fibrous connective tissue making it firm but flexible. The disc is avascular and not innervated. The posterior attachment tissues are highly vascular and richly innervated by branches of the auriculotemporal nerve. The disc proper is designed to transmit and distribute forces generated by the condyle into the articular eminence. The posterior attachment tissues are not designed to withstand joint loading forces. The disc divided the joint into upper and lower spaces. The upper space is larger and more mobile than the lower as the disc is firmly attached to the medial and lateral poles of the condyle. The articulating surfaces are also covered with fibrocartilage. The disc can be divided into 4 parts:

1. Posterior attachment tissues
 - i superior strata
 - ii inferior strata
2. The posterior band (3mm)
3. The intermediate zone (1mm)
4. The anterior band (2mm)

The superior strata of the posterior attachment is inserted into the squamotympanic fissure of the tympanic plate of the temporal bone and is composed of extensible loose weave fibro-elastic tissue. The inferior strata composed of dense inelastic fibrous tissue is inserted into the posteroinferior aspect of the condyle. Anteriorly the disc merges with the joint capsule and fibres of the upper head of the lateral pterygoid confirming its' embryological origins.

In the normal closed position the posterior band envelops the superior aspect of the condyle with the intermediate zone and anterior band lying between the condyle and the posterior slope of the articular eminence. On opening the condyle rotates progressively further in front of the posterior band such that on full opening the condyle is separated from the crest of the articular eminence by the anterior band. There is conflicting evidence on how the condylar - disc relationship is maintained. Electromyographic studies show that the upper head of the lateral pterygoid controls and stabilises the condylar head during closing movements pulling forward against the posterior slope of the articular eminence with the posterior band interposed.

Weakening of the discal attachment either from acute or chronic trauma or both allows the disc to be pulled forward such that the posterior band is anterior to the condyle on closing. The opening and closing clicks characteristic of internal derangement result from the disc alternately relocating and dislocating as the jaw opens and closes respectively. With repeated weakening of the posterior attachment the lateral attachment begins to fail and the click becomes painful. The next phase in the natural history of internal derangement is for the disc to become detached from all but the medial condylar attachment. The lateral pterygoid then pulls it into the anteromedial aspect of the capsule

where it restricts mandibular opening. The click ceases and function is reduced - a closed lock. Treatment of internal derangement is designed to normalise condylar - disc relations. The procedures performed vary with severity of the problem.

Early, painful clicks and hypo function can often be managed arthroscopically by freeing of adhesions. More severe cases with a closed lock may require arthrotomy to surgically retrieve the displaced disc. Depending on its condition the disc may either be reattached or removed. If removed it can be replaced by a variety of materials with varying degrees of long term success.

A period of conservative therapy (3 - 18 months) should be instituted initially in all but the most acute cases which may require IMF for several days.

Indications for surgery:

1. Failed conservative management.
2. Documented disc displacement or other internal joint disorder.
3. Appropriate imaging suggests signs and symptoms are due to disc displacement or other joint disorder.
4. Pain or dysfunction is disabling.
5. Full informed consent.

Treatment Options

1. Correction of displaced meniscus
2. Correction of perforated or torn meniscus
3. Alteration of disc/condyle/articular fossa relationship

Techniques

1 **Arthrocentesis & Arthroscopy** - useful for removal of adhesions in upper joint space and on articular eminence. Will enable "stuck" disc to return to normal position. Allows joint lavage and injection of steroids. No use for totally displaced\disrupted or perforated disc.

Technique:

- a) GA or LA +/- sedation.
- b) Aseptic technique.
- c) Locate upper joint space.
- d) Inject LA into upper joint space.
- e) Insert posterior canula or arthrocentesis canula (walk off arch).
- f) Insert arthroscope into posterior canula.

- g) Insert anterior canula for exit port or instrumentation.
- h) Breakdown adhesions with blunt probe or power shaver.
- i) Constant irrigation with Hartmans' solution.
- j) Inject 1ml (10mg) hydrocortisone when completed.

Should be able to demonstrate increased mouth opening and no click on completion.
 Demonstrate to patient ASAP after completion of procedure. Start active physiotherapy immediately post op.

2 Arthrotomy (open joint procedure)

- a. GA
- b. Preauricular incision
- c. Expose temporalis fascia
- d. Incise onto arch 0,8 cm anterior to anterior external auditory meatus.
- e. Open joint capsule and upper joint space.
- f. Visualise disc.
- g. Reposition or replace disc.
- h. Drain & close wound.

Procedures:

If disc is intact retrieve and suture to lateral capsule and fascia over zygomatic arch.

Maybe remove wedge from posterior attachment tissues to shorten disc.

Some advocate lateral pterygoid myotomy at same time.

If disc ruptured or perforated remove and replace with dermis\ temporalis muscle or silastic sheet.

High condylar shave or condylotomy may be used to increase joint space and allow disc to return to normal position. Surgical approach is same as for arthrotomy but need to distract condylar head from fossa to gain access for shave or condylotomy.

2 Degenerative Joint Disease

- 1 Osteoarthritis - uncommon as TMJ not normally a weight bearing joint.
- 2 Rheumatoid arthritis - TMJ affected in 60 - 70% of sero-positive rheumatoid arthritis cases
- 3 Arthrosis - Arthrosis is seen in 8% of all patients and 40 - 50% of all patients over 40. Females : males 6:1 mean age 53 but 1/3 under 40.

Surgery for both forms of arthritis limited to patients in whom medical and conservative management has failed to control symptoms of pain, crepitus & restriction of movement. For non-responders with continuing signs and symptoms condylectomy + / - joint replacement may be indicated. Results of prosthetic joint replacement are poor with rejection, extrusion, infection, and limited function as common problems.

Arthrosis Presents as pain on biting, joint tenderness , crepitus and restricted opening. Erosions and cystic changes of the condylar head are seen on x-ray. Erosions indicate degenerative changes but are not a specific indication for surgery as many will heal with conservative measures. Those that don't respond are best managed with a high condylar shave or condylotomy.

3. Condylar Hyperplasia

Results from continued growth at condylar growth centre of unknown aetiology. Invariably unilateral, if bilateral is asymmetric.

2 types of deformity:

- i Increased anteroposterior mandibular length with associated buccal cross bite.
- ii Increased vertical ramus height with tilted occlusal plane and lateral open bite.

Results in facial asymmetry and reduced opening on affected side. Asymmetry improves as mouth is opened due to translation of condyle on normal side. Treatment depends on age, degree of deformity and hypofunction. If seen in puberty while still growing condylectomy alone may suffice. If seen later when compensatory growth has occurred will need condylectomy and osteotomies often of mandible and maxilla to restore facial symmetry and normal occlusion.

4 Recurrent Dislocation

Normal joint stability depends on:

- i bony architecture of joint surfaces
- ii integrity of joint ligaments
- iii activity of muscles acting on the joint

Poor development of articular fossa, laxity of temporomandibular ligament or joint capsule and excessive activity of lateral pterygoid and infrahyoid muscles such as in cerebral palsy or as a side effect of phenothiazines can all lead to recurrent dislocation.

Surgery is designed to favourably alter one or more of these factors.

1. Alteration of bony anatomy

- a) augment articular eminence either with autogenous bone, cartilage, hydroxy - apatite or silastic to prevent condylar head dislocating over the eminence.
- b) down fracture of zygomatic arch posteriorly to augment the articular eminence (Dautrey procedure).
- c) reduction of height of articular eminence to allow free condylar movement with spontaneous relocation.

2. Alteration of ligaments

- a) injection of sclerosing agents (STD - 3% sodium tetradecyl sulphate) or blood into joint will induce fibrosis and restrict joint movement.
- b) reinforcement of ligaments and capsule with temporalis fascia or plication of capsule by excising a wedge and suturing.

3. Alteration of muscles

- a) lateral pterygoid myotomy
- b) shortening of temporalis tendon

Which procedure performed depends on underlying cause of the dislocation and results of any previous interventions. In cases due to excessive muscle activity withdrawal of a causative drug or prescription of muscle relaxants should be tried before surgery if possible.

5 Trauma

- i conservative
- ii active - IMF or ORIF

Majority of unilateral condylar fractures can be treated conservatively as the displaced condyle will be brought into near normal position by action of attached muscles. If patient can attain normal occlusion then soft diet and review weekly for 6 weeks until healed. If unable to attain occlusion short period (7 - 10 days in children and 2 weeks in adults) of IMF is indicated. With bilateral fractures always need active treatment as potential for developing anterior open bite and long term deformity is ever present. In most cases IMF as above is indicated. May need to have posterior occlusal stops and anterior elastic traction initially to overcome ramus shortening before IMF applied. For severe fractures (unilateral and bilateral) where condylar head not expected to come into position (gross medial or central dislocation) then ORIF is indicated. ORIF gives better long term results BUT have to weigh up against potential morbidity and fact that in most cases simple treatment gives acceptable results.

6 Ankylosis

Definition: Intracapsular condition characterised by fusion of the bony surfaces of the joint.

Needs to be distinguished from pseudoankylosis which is extraarticular and may be due to conditions like muscle spasm from needle track haematoma, coronoid hyperplasia & temporalis muscle contracture following bitemporal flaps.

Retarded condylar growth with subsequent facial asymmetry is major complication of childhood onset ankylosis not seen in adult onset.

Aeitiology:

- i Trauma
- ii Infection
- iii Neoplasia
- iv Congenital
- v Rheumatoid

Trauma accounts for vast majority of all cases infection and neoplasia are now infrequent causes in western world. Congenital ankylosis occasionally seen but cause is unknown. Likely that some "congenital" cases due to birth trauma especially from forceps delivery. TMJ affected in about 50% of both juvenile and adult forms of RA.

Ankylosis in children usually results from blow to chin causing unilateral or bilateral condylar fracture(s). Causes intracapsular haematoma and subsequent organisation especially if IMF used for > 7-10 days. Incidence of ankylosis following condylar fractures less in adults due to poorer vascularity of condylar head.

Diagnosis: Rarely difficult but not infrequently cases missed. Presents as inability to open mouth with or without mandibular deviation. OPT needed in all cases, CT scan especially with 3D reconstruction often very helpful to visualise medial bone bridges between mandible and skull base. All cases of childhood condylar fractures should be followed up for several years to pick up those cases with growth disturbances to facilitate early treatment.

Treatment: Depends on severity most will require surgery. All abnormal bone growth should be removed between condylar head and zygoma. Often difficult to do on medial aspect of condyle due to poor visibility and proximity of maxillary artery. Extended incision or even bitemporal flap often needed. If articular disc is present and intact it should be left in situ, if damaged it should be removed. If disc absent or removed need to interpose material between condylar head and articular fossa. Can use Silastic, cartilage or temporalis muscle flap.

If growth has been unaffected then the above procedure will often suffice. If there has been growth disturbance then mandibular height and length needs to be restored.

Costochondral graft using 5th or 6th rib is optimal procedure. Cartilage cap is seated into fossa ideally onto temporalis flap and fixed to mandible with wire or mini-plates.

Early mobilisation and a 3 month course of Etidronate a calcium chelating agent very effective in preventing reankylosis. Corrective osteotomies may be required in later life to correct residual asymmetry.

In adults with massive ankylosis a gap arthroplasty sparing the natural articulation is often successful. The condylar neck is sectioned below the ankylosis and silastic or temporalis muscle interposed. This creates a false joint which has good pure hinge opening but poor lateral excursion. Prosthetic joint replacements should be avoided wherever possible.

4. Complications

1. Failure to achieve adequate pain free function
2. Iatrogenic complications directly resulting from surgery or anaesthesia
 - a) anaesthetic
 - b) neurological
 - c) vascular
 - d) infection
 - e) aural
 - f) salivary fistulae

1 Failure to achieve pain free function

- a) Poor patient selection
- b) Incorrect or non-existent diagnosis
- c) Inappropriate choice of operative procedure
- d) Inadequate surgical technique
- e) Inadequate postoperative physiotherapy

A) Poor patient selection

Patient must satisfy indications for surgery previously described. Presence of abnormal imaging does not in itself indicate surgery.

B) Incorrect diagnosis

Unlikely to cure a patient who is given incorrect or no diagnosis preoperatively. In particular must differentiate psychogenic MFPD patients from true organic pathology as the former will not benefit from intracapsular surgery. Remember TMJ pain is a symptom not a specific disease entity and does not dictate a specific treatment. Therefore must diagnose the cause of the pain in order to treat it.

C) Incorrect Treatment

The great variety of treatments available attests to the unsatisfactory nature of many of them. Surgery must address the underlying pathology which must thus be fully understood. Hence the aim must be to return the disc/condyle/fossa relationship to normal and/or decrease pressure on the sensitive vascular structures of the posterior attachment tissues. Operations and occlusal therapies that do not achieve these aims are liable to make the situation worse. Posterior repositioning splints (intentional or otherwise) are particularly bad.

Lack of informed consent also comes under this heading

D) Inadequate Surgical Technique

Surgery needs to be performed by someone who not only has the requisite skill to perform the procedure but understand why it is being done. The difficult part of an operation is not the surgery but deciding what to do on who and when.

E) Inadequate Physiotherapy

All surgical procedures produce an acutely inflamed joint that will heal by scar tissue. If the scar tissue is allowed to mature then joint function will be adversely affected and the

procedure will fail. Active physiotherapy provided by a physiotherapist with an interest and understanding of TMJ disease is mandatory if joint surgery is to succeed. If facilities are not available for adequate postoperative physiotherapy then it is likely that the operation will fail and arguably should not have been performed in the first place.

2 Iatrogenic Complications

A) Anaesthetic

Same as for any procedure under GA. In USA fatality rate = 1:90,000 for ASA1 patients.

B) Neurological

Damage to facial nerve is most common and problematic complication. Temporary weakness of forehead occurs in 10 - 15% of cases and < 1% have functional deficit of upper eyelid movement. Overwhelming majority resolve as oedema reduces. Division of auriculotemporal nerve often occurs and results in anaesthesia over temple. Frey's syndrome is relatively uncommon.

C) Vascular

Maxillary artery is at risk immediately deep to condylar neck. Condylectomy, condylotomy or arthroscopy may sever vessel. Haemostasis may require ligation of external carotid artery.

D) Infection

If strict adherence to aseptic technique maintained postoperative infection is uncommon. More likely if allografts and joint prostheses used. Broad spectrum antibiotics used for arthrotomy cases but not routinely for arthroscopy.

E) Aural

Strictures, granulomas of external canal may occur as a result of perforation of anterior wall. Usually respond to simple debridement.

F) Salivary Fistulae

Damage to parotid gland resulting in salivary fistula may occur during exposure of the joint. Treatment depends on size of fistula and may be conservative or operative.

5. Physiotherapy

As mentioned before physiotherapy is vital to prevent postoperative fibrosis hypofunction and pain. Physiotherapy should be co-ordinated regimen involving active and passive joint opening, lateral excursion and protrusion. Simple hand held devices can be used and CPM machines are available. Alternating moist heat and cold over the joint before exercising will help reduce pain and swelling. Transcutaneous nerve stimulation is also useful for reducing pain and improving exercise tolerance. Movements should be sufficient to prevent scar tissue forming but not so large as to damage healing structures and tear sutures. This is why a physiotherapist with interest in TMJ surgery is needed. Very good results in USA largely due to open access to physiotherapy. Essentially unavailable here.