What Dentists Should Know about the Temporomandibular Joint (TMJ)

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Learning Outcomes

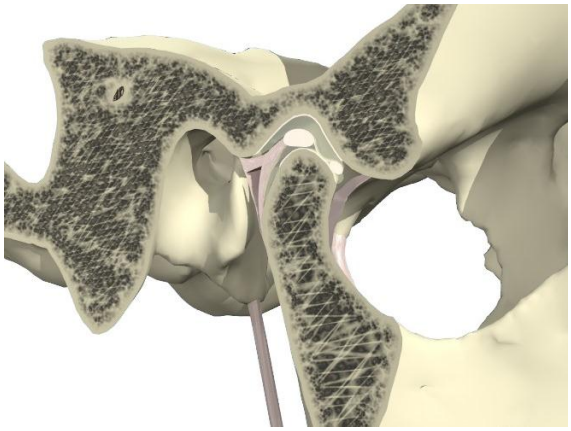
1. The TMJ 'Controversy'
2. TMJD Diagnosis
3. Conservative Management of TMJ Disorders
4. Arthroscopic Surgery of the TMJ
5. Open Joint Surgery and the Role of Eminoplasty
6. Condylar Fractures (Open Reduction and Fixation)
7. Alloplastic Total Joint Replacement (TJR)

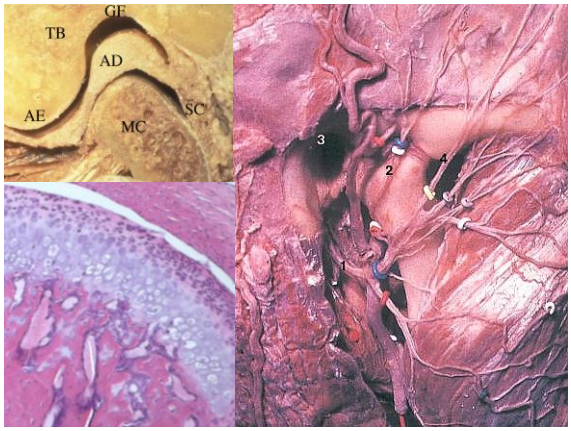
TMJ Diagnosis

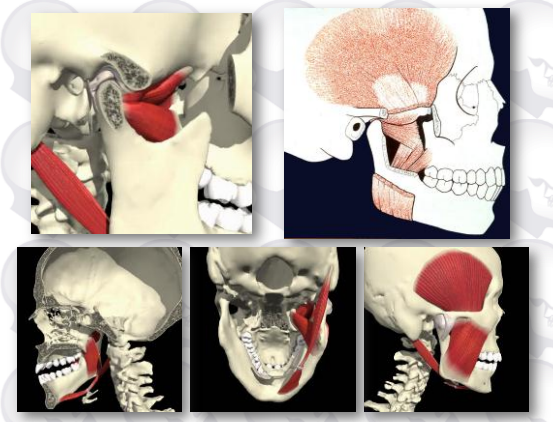
- Myofascial Pain Dysfunction, Mandibular Dysfunction, Facial Arthromyalgia
- Common Condition *(Rugh 1985, Shiffman 1988, Wadha 2008)*
  - 33% population have one symptom
  - 75% have one or more signs
  - Diagnos in 6 – 12% percent of adult population
- Female ♀ : Male ♂ up to 10:1
- Young > Old (different pathogenesis)
- Associated Diseases

Is it Confined to Western Societies?

- Abdel-Hakim AM. **Stomatognathic dysfunction in the western desert of Egypt: an epidemiological survey.** J Oral Rehabil. 1983 Nov;10(6):461-8; The most prevalent symptoms were headache (29%), pain in the ear (24%) and clicking joint sounds (19%); 84% of the subjects suffered from tenderness of one or more of the masticatory muscles; 8% of the subjects had painful movements of the mandible.

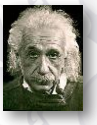






Heuristic Methodology

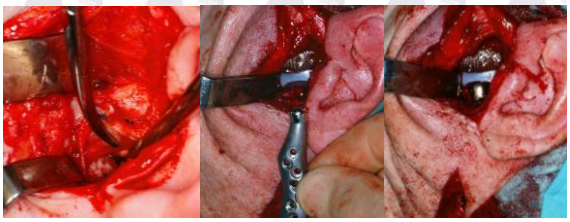
- A heuristic method is used to rapidly come to a solution that is reasonably close to the best possible answer, or "optimal solution".
- Heuristics are "rules of thumb", educated guesses, intuitive judgments.....or simply common sense.



Albert Einstein
1879 – 1955

"Treating Temporomandibular Joint Disorders Is Like Looking For A Good Restaurant In An Unfamiliar Town - It's Hard To Know Which Joint To Enter And Which One To Stay Out Of..!!"

(Edward Seldin.**The emperor's new meniscus.** J Am Dent Assoc. 1983 May;106(5):615-6.)



The Joints to Stay Out Of !

Patient with a chronic headache/clicking TMJ, who has no signs of mandibular dysfunction
(Greene CS: Hands in the Pocket Diagnosis!)

- Can open mouth without pain
- Can eat a regular diet
- No history of direct trauma to the jaw coincident with the onset of the pain

The Joints to Treat

- Pain
- Click/ Crepitus
- Locking
- Restriction of opening (<40mm)
- Other joint pathology
- (Change in Occlusion/Bite)
- (Other causes of facial pain)

NOT HEADACHE.!!

The experience of the past 150 years in the diagnosis and management of chronic orofacial pain conditions has shown that a mechanistic, narrow approach is likely to produce iatrogenic harm, e.g., unnecessary root canal therapy, extractions, restorations, *TMJ surgery*, etc.

Turp JC, Hugger A, Sommer C: **Orofacial Pain – A Challenge and Chance (Not Only) for Dentistry**. In, Turp JC, Hugger A, Sommer C (Eds) **The Puzzle of Orofacial Pain: Integrated Research into Clinical Management**. Karger. Basel. 2007

Problem #1

Patients, physicians, many dentists and third party carriers are using the wrong terminology!

Examples:

- TMJ Internal Derangement (ID)

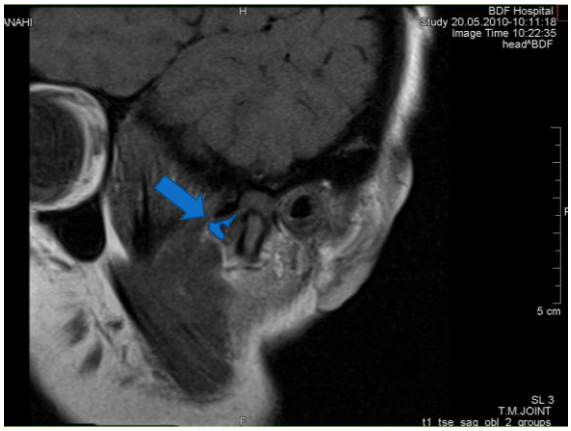
  Wilkes CH. **Structural and functional alterations of the temporomandibular joint.** Northwest Dent. 1978 Sep-Oct;57(5):287-94.
- Anchored Disk Phenomenon

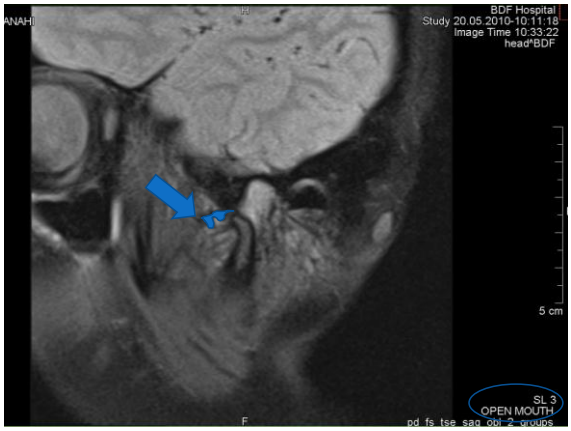
  Nitzan DW, Dolwick MF. **An alternative explanation for the genesis of closed-lock symptoms in the internal derangement process.** J Oral Maxillofac Surg. 1991 Aug;49(8):810-5; discussion 815-6.
- Condylar Hyperplasia

  Obwegeser HL, Makek MS. **Hemimandibular hyperplasia--hemimandibular elongation.** J Maxillofac Surg. 1986 Aug;14(4):183-208.

Wilkes (1987) Staging of TMJ ID

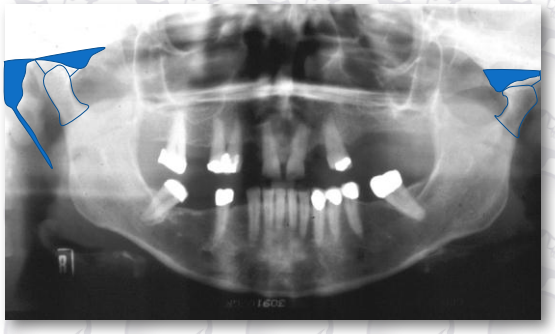
- Stage I:
  - Early clicking
  - **Slight forward disc displacement** with good anatomic contours
  - Anterior disc displacement with incipient bi-laminar zone elongation
- Stage II:
  - Episodes of pain, mid to late opening loud clicking with transient locking
  - **Forward disc displacement** with beginning deformity
  - Anterior displacement, bi-laminar elongation and early adhesions

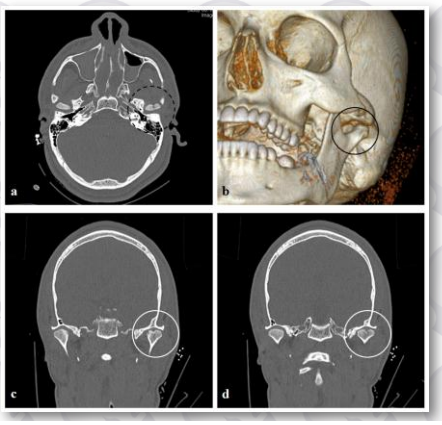


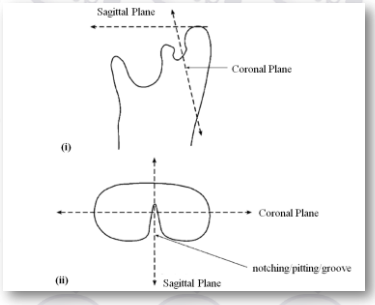


Wilkes (1987) Staging of TMJ ID

- Stage III:
  - Multiple episodes of pain, intermittent locking and restriction of motion and function
  - **Anterior disc displacement** with significant deformity
  - Advanced bi-laminar elongation with redundancy and prominent adhesions
- Stage IV:
  - Slight increase in symptoms over Stage III
  - increase in severity over Stage III with **early** to **moderate degenerative joint** disease on tomogrammes
  - increase over intermediate stage, hyalinization, rupture, cratering and bone exposure

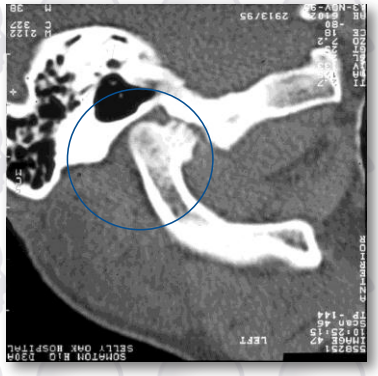






Wilkes (1987) Staging of TMJ ID

- Stage V:
  - Crepitus, scraping and grinding, episodic or continuous **pain** and **chronic restriction of motion** .
  - Disc or attachment **perforation** with **gross disc deformity** and **degenerative joint disease** on tomogrammes.
  - prominent fibrillations, perforation, adhesions of the disc, with cratering and bone exposure.



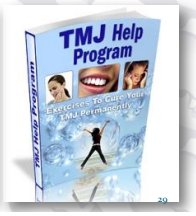
Problem #2

There are multiple and confusing signs and symptoms

Signs	*Symptoms*
• Decreased Jaw ROM	• TMJ noises
• TMJ noises, locking	• Jaw stiffness and fatigue
• TMJ tenderness	• Facial and/or jaw pain
• Masticatory muscle tenderness	• Locking
• Pain increases with jaw movement	• Dental sensitivity
• Masticatory muscle hypertrophy	• Tinnitus
• Excessive dental attrition	• Earaches
	• Headaches

Problem #3

The dental profession embraced the concept that the TMJ is a unique articulation and therefore focused diagnostic and therapeutic modalities in the past on the occlusion and more recently on the intra-articular disc position.



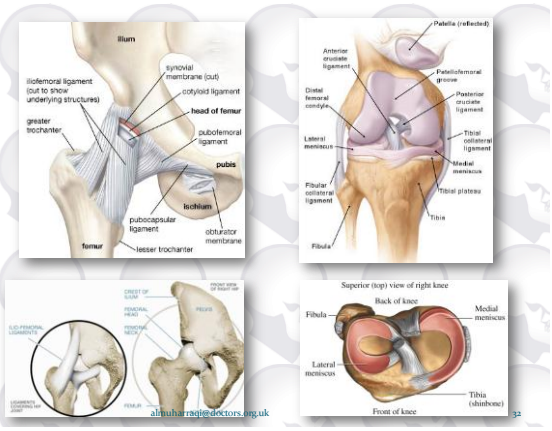
"Uniqueness" of the TMJ

Stegenga B, de Bont LG, Boering G. **Osteoarthrosis as the cause of craniomandibular pain and dysfunction: a unifying concept.** J Oral Maxillofac Surg. 1989 Mar;47(3):249-56.

- Bilateral articulation with the cranium
- Occlusion and articulation of teeth affect joint movement and condylar positions
- Articular surfaces are fibrocartilage rather than hyaline cartilage
- TMJ contains an articular disc

Orthopedics

- Orthopedics (also spelled orthopaedics) is the branch of surgery concerned with acute, chronic, traumatic, and overuse injuries and other disorders of the musculoskeletal system.
- Orthopedic surgeons address most musculoskeletal ailments including arthritis, trauma and congenital deformities using both surgical and non-surgical means.
- Nicholas Andry coined the word "orthopaedics", derived from Greek words for "correct" or "straight" ("*orthos*") and "child" ("*paidion*"), in 1741, when at the age of 81 he published *Orthopaedia: or the Art of Correcting and Preventing Deformities in Children*.



Resulting In The Opinion…

"… treatment is necessary to prevent progression of internal derangement disorders from progressing to degenerative joint disease."

Rasmussen, OC. **Description of population and progress of symptoms in a longitudinal study of temporomandibular joint arthropathy.** Scan J Dent Res 89:196-203, 1981

Alternatively

"…Temporomandibular joint disorders have been characterized as self-limiting, or non-progressive conditions."

Rugh, JD and Solberg, WK. **Psychological implications in temporomandibular joint dysfunction.** Oral Sci Rev 7:3 - 30, 1976.

If this is a chronic, progressive, non-self-limiting condition, one would expect that its incidence in the population would increase with age!

DATA

12% overall prevalence of TMD pain that peaked in women in the childbearing years fell to < 4% for women 65 years of age and older (even lower for men)

Van Korff, M; Dworkin, SF; **LeResche, L and Kruger, A: An Epidemiologic comparison of pain complaints.** Pain 32:173, 1988

Why the Controversy ?

- Insufficient objective scientifically derived clinical evidence
- Failure to effectively communicate existing evidence to the profession
- Failure to use well-communicated scientific evidence
- Dependence on clinical trial and error
- Over-dependence on subjective reports of clinical success
- Low appreciation that clinical successes, though noteworthy, are not scientific proof of cause and effect.

Mohl, ND, Ohrbach, R. **The dilemma of scientific knowledge versus clinical management of TMD.** J Prosth Dent 67:113-120, 1992.

Problem #4

Sophisms
No science
Poor science
Opinion
Cults

Table 1 Relations among diagnosis, etiology and treatment in TMDs

Standard	Diagnosis	Etiology	Treatment
Ideal	Correct Measurable Demonstrable	Specific Measurable Treatable	Anti-etiologic Definitive/curative Successful
Acceptable	Presumptive Probably correct Universal labels	Unclear Complex Reversible	Validated response Matched to diagnosis Conservative
Wrong/bad	Personal label Technologic diagnosis Possibly correct	Experience based Morphofunctional analysis Mechanistic	Prolonged use of an oral appliance Bite-changing procedures Jaw-repositioning procedures
Fringe	Misdiagnosis of pain Neglect pathology Neglect chronicity	Guru/cult concepts Quackery concepts Specialty bias	Whole-body procedures Unorthodox treatments Extreme dental intervention

Adapted with permission from Greene.[3]

Why Do Some Adhere to Concepts that Have Proven to be Scientifically Invalid ?

- Early professional training and experience
- Reinforcement of familiar procedures
- Inertia
- Isolation
- Insecurity
- Unfamiliarity with the literature
- Inability to assess scientific evidence
- Blind belief in "schools of thought" sponsored by charismatic gurus
- Economics

Mohl, ND, Ohrbach, R. **The dilemma of scientific knowledge versus clinical management of TMD.** J Prosth Dent 67:113-120, 1992.

Requirements of Scientific Clinical Research

- Clearly defined inclusion and exclusion diagnostic criteria
- Inter-examiner and intra-examiner reliability
- Clearly defined measures
- Sufficient number of subjects with repeated measures
- Random assignment of subjects
- Data collected by "blinded" examiners
- Replicability of data by other investigators
- Use of placebos
- Control groups to control for bias
- Appropriate sample size

Mohl, ND, Ohrbach, R. **The dilemma of scientific knowledge versus clinical management of TMD.** J Prosth Dent 67:113-120, 1992.

Problem #5

Misdiagnosis leading to improper and/or inappropriate management

...Iatrogenic Disease

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TMJ Differential Diagnosis

Dental pain
Sinus "pain"
Neuralgias
Headaches
Migraines
Atypical facial pain syndromes
NB Pain and lump in parotid ➡ malignant

Diagnostic Dilemmas

Facial Pains
Dental pain
Sinus pain
Headaches
AFP

TMJ Pains
Myofascial pain
⬇
Internal derangement

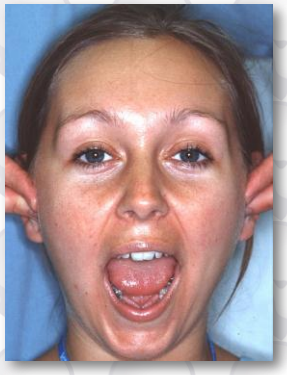
Anchored Disc Phenomenon

TMJ Palpation

Tenderness
Click

Palpation for Click

Examination for Deviation



Palpation of Masseter

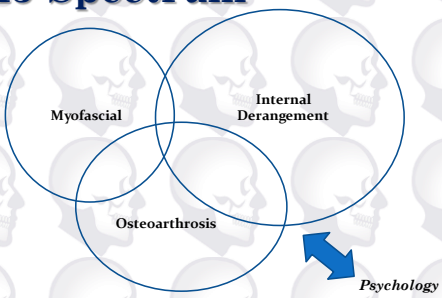
Tenderness
Spasm

Palpation of Temporalis

Pre-Interventional Imaging

- Diagnostic Imaging
  1. OPG, Trans-cranial (Lateral Oblique), Trans-Pharyngeal, Reverse-Towne's
  2. 'Bone Scan'
  3. Arthrography
  4. CT
  5. MRI (Dual Surface Coil)

TMJ Spectrum



Conservative TMJ Management

- Advice and Reassurance
- Bite Splints
- Physiotherapy
- Occlusal Modification
- Orthodontics
- Biofeedback
- Medications

Evidence Based Approach

- Problems
  - Tendency to "traditional" approach
  - Follow guidance of "trainer"
  - Do what you are used to doing
  - Do what you are able to do
- Solution
  - Use the evidence

Evidence Based Approach

- Problems (14,000+ refs since 1966)
  - No strong evidence
    - Many case reports
    - Several case series
    - Few controlled trials
    - Very few randomised controlled trials (RCT)
- Solution
  - Use what evidence there is
  - DO NO HARM

Advice & Reassurance

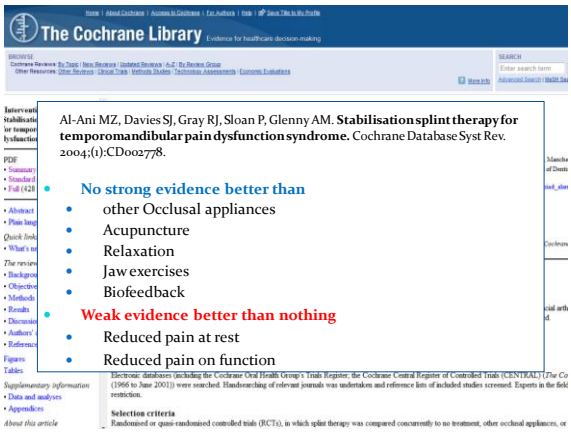
- Placebo effect
  - "cures" 40% no matter what you do
- Empowerment of patient
  - controls internet mis-advise
- Supported in written format
  - improves retention of knowledge

Advice & Reassurance

- Common problem
  - 30% population will have click
- Benign condition
  - does NOT usually progress to arthrosis
- Usually treatable conservatively
  - <10% of secondary referrals ➜ arthroscopy
  - 1% of secondary referrals ➜ surgery

Bite Splints

- Various Varieties (suggests none works best)
  - Lower soft BRA
  - Stabilisation splint
  - Anterior repositioning appliance
  - Hard bite splint
- Ensure FULL occlusal coverage



Al-Ani MZ, Davies SJ, Gray RJ, Sloan P, Glenny AM. **Stabilisation splint therapy for temporomandibular pain dysfunction syndrome.** Cochrane Database Syst Rev. 2004;(1):CD002778.

- **No strong evidence better than**
  - other Occlusal appliances
  - Acupuncture
  - Relaxation
  - Jaw exercises
  - Biofeedback
- **Weak evidence better than nothing**
  - Reduced pain at rest
  - Reduced pain on function

Physiotherapy

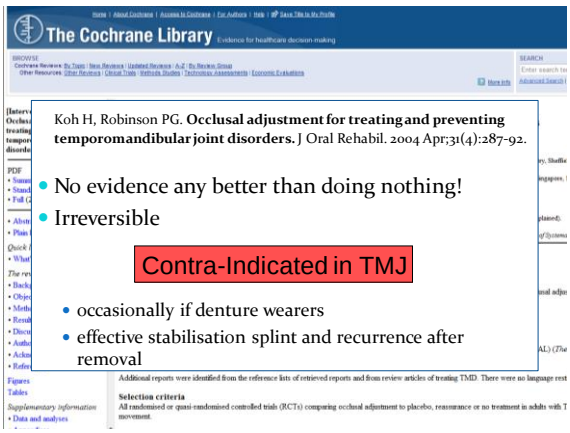
- Manipulation and opening exercises
- Ultrasound
- Laser
- Shortwave diathermy
- TENS
- Acupuncture

Physiotherapy

- No good evidence for long term effect in ANY musculo-skeletal condition

BUT

- Reversible and non-harmful
- Some short-term benefit (?biofeedback)



Koh H, Robinson PG. **Occlusal adjustment for treating and preventing temporomandibular joint disorders.** J Oral Rehabil. 2004 Apr;31(4):287-92.

- No evidence any better than doing nothing!
- Irreversible

Contra-Indicated in TMJ

- occasionally if denture wearers
- effective stabilisation splint and recurrence after removal

Orthodontics

Behrents RG, White RA. **TMJ research: responsibility and risk.** Am J Orthod Dentofacial Orthop. 1992 Jan;101(1):1-3.

- Department of Orthodontics, College of Dentistry, University of Tennessee, Memphis 38163
- Court case 1988 orthodontist sued for "causing" TMJ problems
- Funding research by American orthodontists to investigate
- Whole issue devoted to outcome of this

Orthodontics

Summary of Findings

- Extraction of upper 4s and upper 2 to 2 retraction did not "distalise" condyles
- Correction of malocclusion does not necessarily improve TMJ symptoms
- TMJ symptoms may develop (and disappear) independently of orthodontics
- Tendency to improve TMJ symptoms
- Clicking does not usually progress to locking or arthrosis

Orthodontics

In Conjunction with Orthognathic Surgery

- 50% No Better
- 30% Better
- 20% Worse

TMJ not an indication for orthognathic surgery

Orthodontics

Schellas KP, Piper MA, Bessette RW, Wilkes CH. **Mandibular Retrusion, Temporomandibular Joint Derangement, and Orthognathic Surgery Planning.** Plas Recon Surg, 90(2):218-229 1993.

- Retrospective analysis of 100 orthognathic surgery candidates with mandibular retrusion
- 58 unstable and 30 of 42 stable patients found to have ID of at least one TMJ
- Preoperative MRI of TMJ recommended prior to surgical correction of retrognathic deformities

Bio Feedback

- **Aim** to Change Perception and Appraisal of Pain
  - Emphasis on Self-management
  - Education
  - Stress Management
  - Hypnosis
  - Psychoanalysis

Bio Feedback

- Useful and effective for chronic pain
- Scientifically validated
  - Psychoanalytical Methodology
  - Related To Psychological Disturbance (Anxiety, Stress And Depression)

Successful for long term management of chronic TMJ pain

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
  - Paracetamol
    - effective for simple pain relief
    - not effective for treatment
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
- NSAIDs
  - Systemic
    - effective for pain relief
    - reduce inflammatory mediators
    - ibuprofen 600mg tds
    - risk of GI side-effects
    - risk of exacerbation of asthma
    - no evidence for long term efficacy
  - Topical
    - as effective with fewer side-effects
    - ? local effect of massage
    - 4-6 times daily
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
  - only for chronic pain
  - only under supervision of pain specialist
  - drugs of last resort
  - high risk of dependence
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
  - Diazepam
    - 2-5mg at night, possibly tds
    - reduce muscle spasm acutely
    - anxiolytic
    - no long term efficacy
    - use as short course (2 weeks max)
    - risk of dependency
    - risk of misuse (black market)
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
  - Tricyclics or SSRI
  - low dose are anxiolytic and muscle relaxant
  - side effects GI upset (both), dry mouth and sedation (TCA)
  - positive benefit for chronic non-malignant pain
- Local analgesics
- Botulinum toxin
- Steroids

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

- no RCT but fair evidence of benefit in myofascial pain
- 25mg TCA rising with therapeutic effect (wait 3/52)
- 10-20mg SSRI (no evidence for TMJ pain)
- regular review under care of hospital/GP
- Maintenance dose for 6/12 once pain free
- Slow withdrawal (risk of s/e)

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

- useful for diagnostic purposes
- LA to TMJ may help anchored disc (arthrocentesis)
- LA to trigger points in muscle may help break cycle
- no evidence for long term benefit

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

(UNLICENCED)

- Cures the wrinkles therefore makes them better!!!!
- paralysis of muscle by blocking acetylcholine
- weakens large muscles (masseter)
- trigger point injection for myofascial pain
- early evidence but long term benefit not studied
- 50 units Dysport to masseter/temporalis in up to 3 points

Medical Therapy

- Simple analgesics
- NSAIDs
- Opioids
- Benzodiazepines
- Anti-depressants
- Local analgesics
- Botulinum toxin
- Steroids

- injection into joint
- beneficial for OA generally (good evidence)
- use with caution
- articular erosion after more than 2 injections
- post-arthroscopy capsulitis

TMJ Arthroscopy

- Pre-arthroscopy treatment
- Indications
- Technique
- Findings
- Post-operative care
- Complications
- Outcomes

Pre-Arthroscopy Treatment

- Visit 1
  - Advise, reassure
  - Soft diet, avoid wide opening
  - Topical NSAIDs, soft BRA
  - 8 weeks active treatment

Pre-Arthroscopy Treatment

- Visit 2
  - Persist with BRA, NSAIDs
  - Discuss and list arthroscopy
  - Consider muscle relaxant
  - 8 weeks

Indications

- IN AN IDEAL WORLD
- Pre-operative physiotherapy is part of conservative regime
- MRI scan

Technique

- General Anaesthesia
  - (antibiotic prophylaxis)
  - nasal intubation
- EUA
- MUA
- Arthroscopy
- Arthrocentesis

Indications

- Failed conservative therapy with
  - Restricted opening
  - Persistent pain
  - Locking

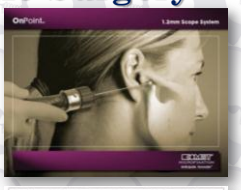
Anterior Open Bite Patients Should Bypass Arthroscopy

Technique

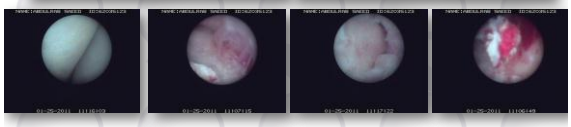
- Measure Opening
- MUA
- Can Opening be Improved

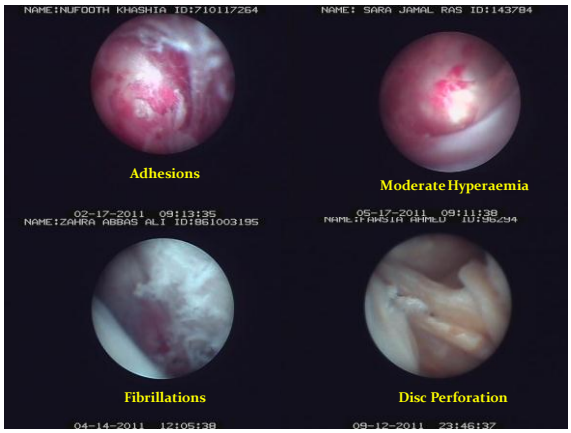
Arthroscopic TMJ Surgery

- Rigid fibre-optic technology to visualize the **superior** & **inferior** spaces of the temporo-mandibular joint (TMJ) in a clinic and operating theatre settings under **LA + intravenous sedation** or **GA**
- Since it comes in a **1.2mm (18 gauge needle)** Scope System it is designed to provide minimally invasive diagnostic and operative procedures with a second channel insertion



Arthroscopic TMJ Surgery





Arthrocentesis

- normal saline with 1000 units heparin
- 200 ml
- 150mmHg pressure

Post-Operative Care

- Check airway
- Gentle active mobilisation
- Passive mobilisation after few days
- Heat to joint
- Physiotherapy to assist in above
  - Mobilisation
  - Ultrasound

Complications

1. Uncommon
2. Swelling
3. Weakness of temporal CNVII
4. Sensory loss auriculo-temporal
5. Disturbance of hearing
6. Intra-cranial perforation

Outcome

International Series

- Anchored Disc Phenomenon 95% cure
- ADD Without Reduction 70% cure

Conclusion

- Following Failed Conservative Treatment
- Diagnostic
- Therapeutic

What to Refer

- Pain
- Restriction Of Opening (<35mm)
- Locking
- Associated Rheumatological Disease
- Recurrent Dislocation
- Facial Deformity

Not Just a Click

Open TMJ Surgery

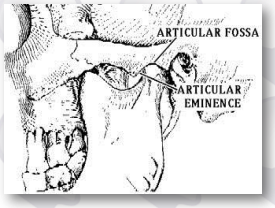
The Normal TMJ

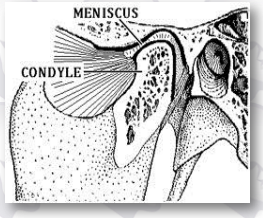
- Synovial joint with pathology and dysfunction similar to other joints
- Paired joint with its final position determined by the teeth and not ligaments
- Not a non-weight bearing joint
- Ginglymoarthrodial articulation
- Complex tri-axial range of movements
- Biting results in a TM joint reaction force
- Pressure in the joint space is slightly negative at rest, up to +200mmHg on clenching and -130mmHg on opening
- Intra-articular pressure varies between individuals, **is greater in females and is decreased by bite splints**

TMJ Anatomy

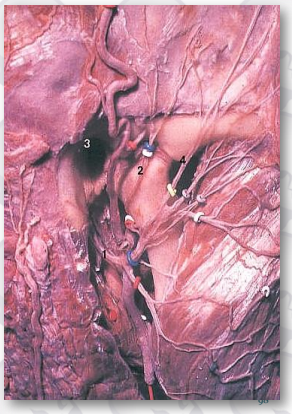
- Rests in the glenoid fossa
- Collagenous articular disc (intracapsular meniscus)
- Zones of the meniscus *(Rees et al, 1954)*
  - Anterior band – attached to fossa & condyle
  - Posterior band – attached to SH Lat. Pterygoid
  - Intermediate band
- Innervated by the masseteric & auriculo-temporal branches of V^3

Parasagittal section of the TMJ





1. **Facial Nerve Trunk**
2. **Auriculo-Temporal Nerve**
3. **External Auditory Meatus**
4. **Temporal Branch of the Facial Nerve**



Pre-Surgery

- Diagnostic Imaging
  1. OPG, Trans-cranial (Lateral Oblique), Trans-Pharyngeal, Reverse-Towne's
  2. Bone Scan
  3. Arthrography
  4. CT
  5. MRI (Dual Surface Coil)

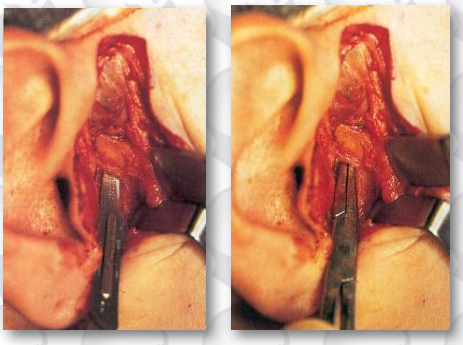
Indication for TMJ Surgery

1. Internal Derangements
2. TMJ Hypermobility (Recurrent Dislocation)
3. Ankylosis
4. Advanced Degenerative Joint Disease
5. Condylar Fractures
6. Benign/Malignant Lesions of the TMJ or Condyle

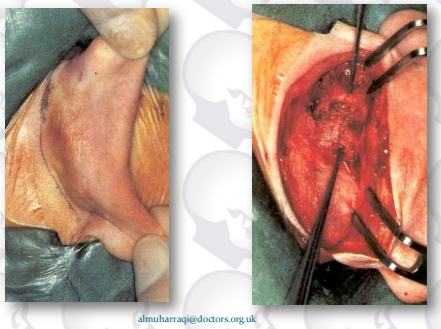
Surgical Approaches to the TMJ

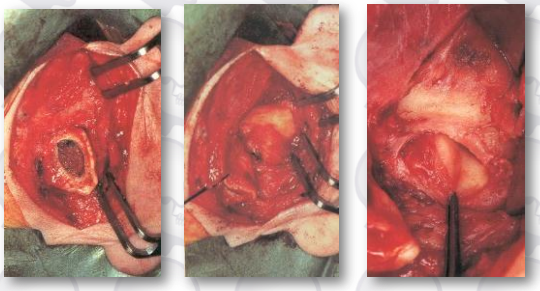
1. Pre-auricular
2. Endaural
3. Post-auricular
4. Rhytidectomal
5. Submandibular (Retro-mandibular)
6. Intraoral
7. Through Existing Lacerations

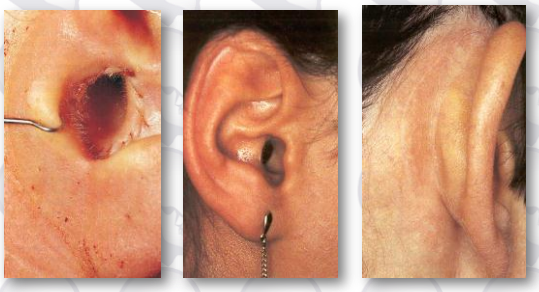
Endaural (Pre-auricular) Approach



Post-auricular Approach







TMJ Internal Derangement

Internal Derangement of the TMJ

- Also known as TMJ Disk Interference Disorder
- Most common TMJ Arthropathy
- Aetiology:
  - Controversial
  - Trauma plays a major role.
    - Acute macro trauma - Fall, or blow to the face
    - Chronic micro trauma - Parafunctional activities (nocturnal clenching and/or bruxism)

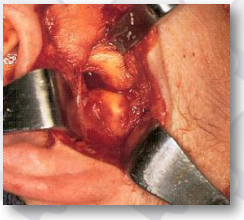
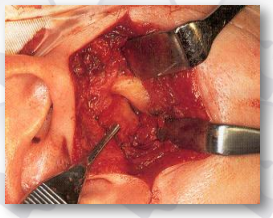
Surgery for: Internal Derangements

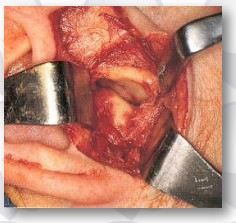
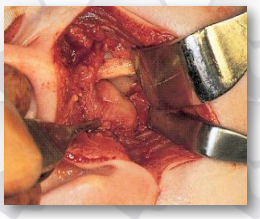
1. Surgery ***without*** Disk Repositioning
   a. Arthrocentesis
   b. Arthroscopic lysis and lavage
   c. Arthroplastic release of adhesion with temporary silastic implant
   d. Eminectomy
   e. Diskoplasty (recontouring)
   f. Modified condylotomy

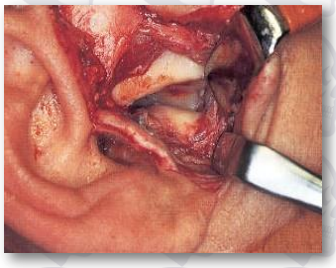
Surgery for: Internal Derangements

2. Surgery ***with*** Disk Repositioning
   a. Arthroscopic disk repositioning
   b. Disk Plication
   c. Diskopexy
   d. Diskectomy without replacement
   e. Diskectomy with replacement (dermis, cartilage, fascia, temporalis, etc.)
   f. Eminectomy

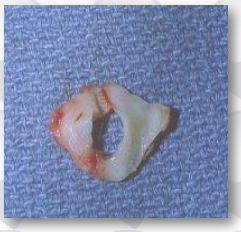
Eminectomy with Disk Plication

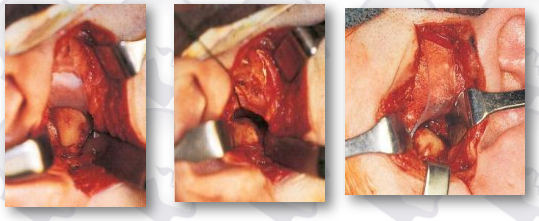



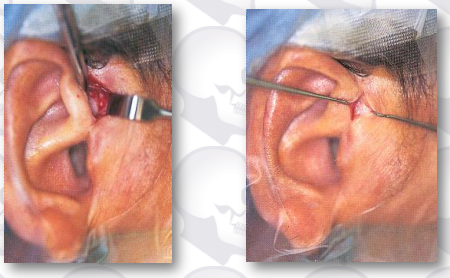


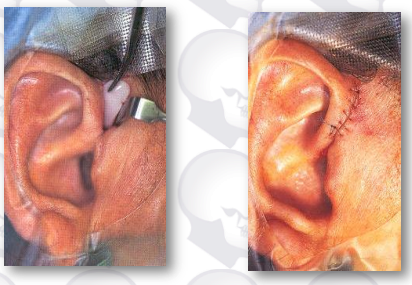
Diskectomy without Replacement

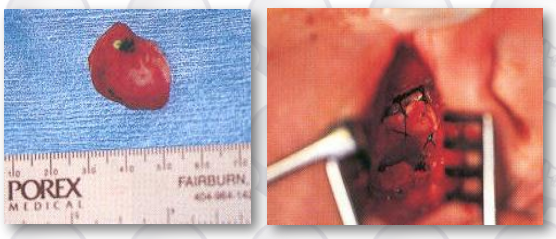
Diskectomy with Replacement







Diskectomy with Replacement



TMJ Hypermobility (Recurrent Dislocation)

Condylar Hypermobility

- Acute, Chronic (Habitual), Long Standing
- A triad are recognised in the genesis of TMJ subluxation:
  - Ligamentous and capsular flaccidity
  - Eminential deformation
  - Trauma
- Aetiology:
  - Post-traumatic
  - Spontaneous
  - Associated with psychiatric illness
  - Drug therapy

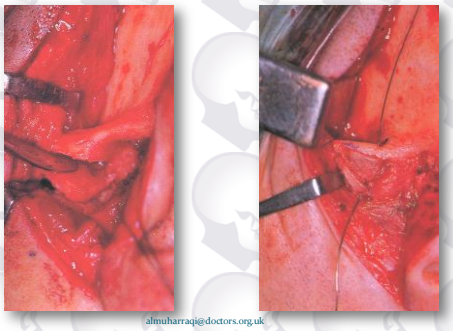
Condylar Hypermobility

- Precipitating Factors:
  - Yawning
  - Vomiting
  - Laughing
  - Extremes of Masticatory Effort (taking a bite from a big sandwich)

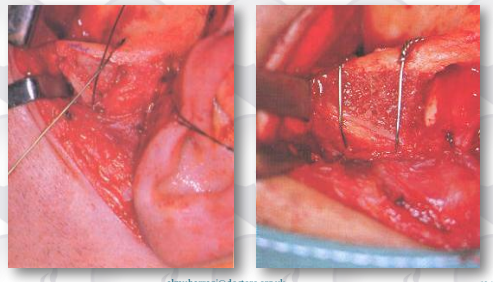
Surgery for: TMJ Hypermobility

- Lateral pterygoid myotomy
- Restrictive techniques:
  - Le Clerc – eminence down fracture
  - Dautrey – eminence lengthening
- Obstruction removal techniques:
  - Eminectomy

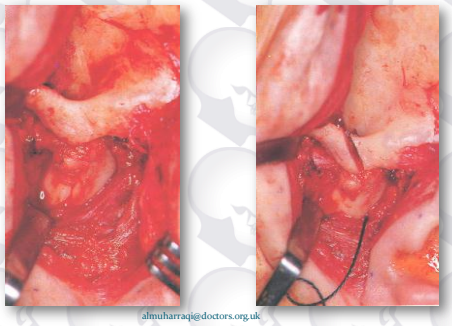
Eminence Down Fracture



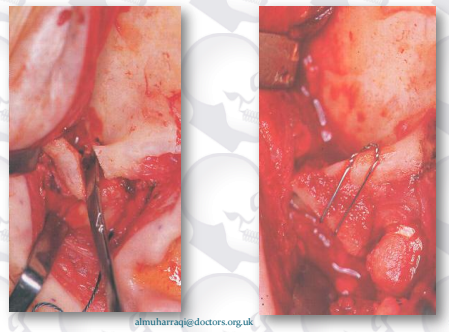
Eminence Down Fracture



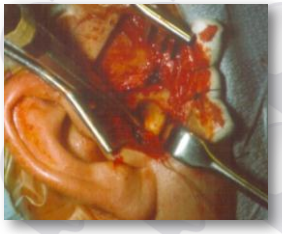
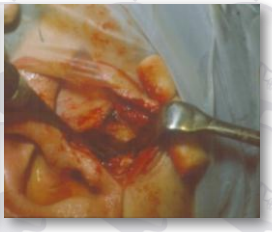
Zygoma Arch Down Fracture



Zygoma Arch Down Fracture



Eminectomy

TMJ Ankylosis

TMJ Ankylosis

- Rowe defined **pseudo**, **true** and **false ankylosis**
- Osseous, fibrous, fibro-osseous or cartilaginous fusion of the bone joint and articular surfaces
- Four types are described:
  - **Type I** – flattened condyle and limited space
  - **Type II** – bony fusion at outer margins
  - **Type III** – bony fusion between ramus and zygomatic arch
  - **Type IV** – entire joint replacement

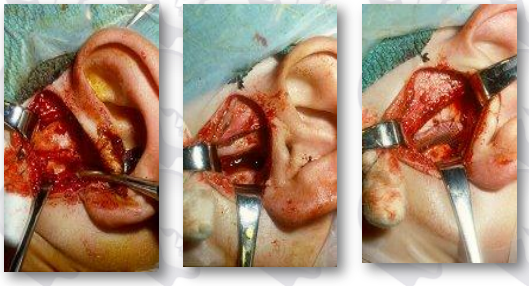
Aetiology of TMJ Ankylosis

- Trauma
  - Sub-condylar fractures
  - Intra-capsular fractures
- Still's Disease (juvenile chronic arthritis)
- Rheumatoid Arthritis
- Joint Infection
- Tumours (villo-nodular synovitis)

Surgery for: TMJ Ankylosis

- Bony Ankylosis:
  - Arthroplasty with autogenous graft
  - Condylectomy with autogenous or alloplastic graft
- Fibrous Ankylosis:
  - Arthroplasty with meniscal salvage
  - Arthroplasty with meniscesectomy (with or without autogenous or alloplastic grafting)

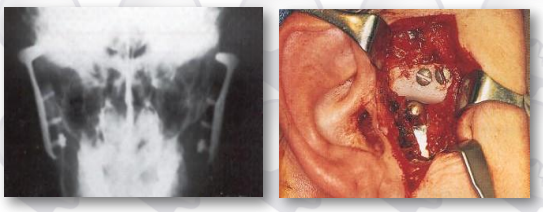
Arthroplasty with Alloplastic Graft

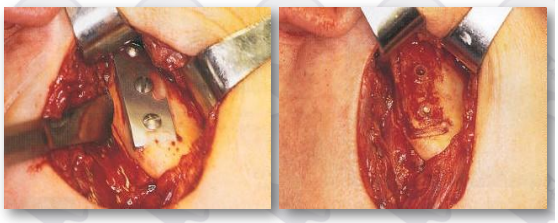


Alloplastic Condylar Prostheses

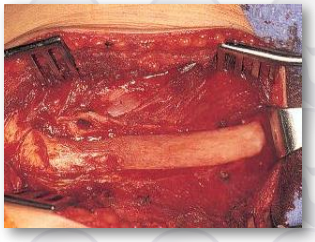
1. Kent-Vitek
2. Synthes
3. Derlin-Timesh
4. Christensen I
5. Christensen II
6. Biomet-Lorenz

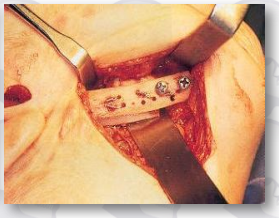
Condylectomy with Alloplastic Graft





Condylectomy with Autogenous Graft

TMJ Degenerative Disease

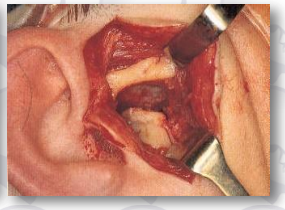
Common Degenerative Conditions

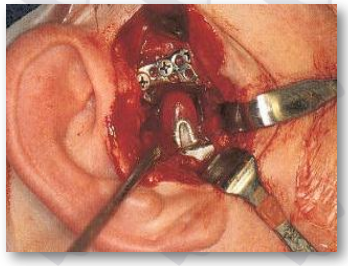
- Osteoarthritis
  - Increasing incidence after 50 years
  - Pain, crepitus, limitation of movement
  - Preceded by TMD or Internal Derangement
  - Degenerative changes, denudation, & eburnation of condyle
- Rheumatoid Arthritis
  - Common in patents with generalised RA
  - Stiffness, limitation of movement
  - Erosion of condyle by vascular pannus

Surgery for: Degenerative Disease

- Arthroplasty with diskectomy – replacement (dermis, cartilage, fascia, temporalis, etc.)
- High condylar shave (partial condylectomy)
- Joint replacement:
  - Alloplastic
  - Autogenous (costachondral, SCM, Ileum, clavarial, etc.)

Joint Replacement



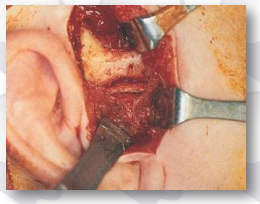
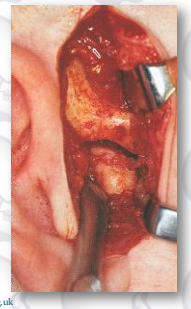

Unusual Diseases of the TMJ

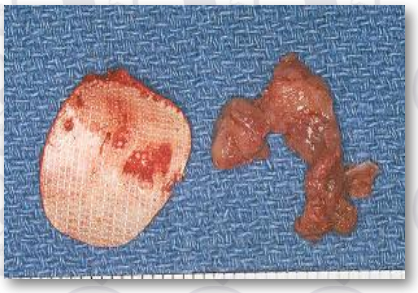
1. Benign Lesions
    1. Chondroma
    2. Synovial Cyst (Ganglion Cyst)
    3. Osteo-chondromatosis
    4. Suppurative Arthritis
    5. Benign Chondroblastoma (Codman's Tumour)
    6. Aneurysmal Bone Cyst
    7. Chondrocalcinosis
    8. Synovial Fistula
    9. Aseptic Necrosis

Unusual Diseases of the TMJ

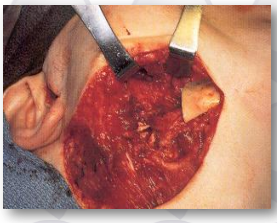
2. Malignant Tumours
    1. Osteogenic Sarcoma
    2. Chondrosarcoma
    3. Synovial Cell Sarcoma
    4. Multiple Myeloma
    5. Lymphoma
    6. Aggressive Fibromatosis

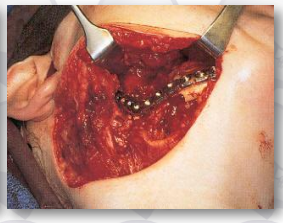
Foreign Body (Giant Cell) Response

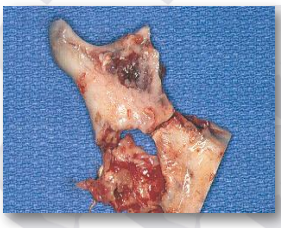





Aggressive Fibromatosis







Condylar Fractures

Transmasseteric Antero-Parotid Approach

Case Presentation…

- 32-year-old Bahraini male, Royal National Guards
- No relevant medical history, and on no medications with no known allergies
- Presented with: severe pain from 'jaw', malocclusion and step deformity, multiple avulsed teeth following a 'fall' from his jet ski

Case Presentation…

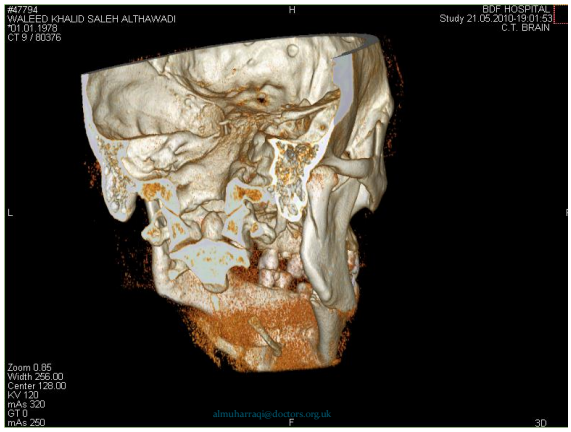
- Trismus (<25mm)
- Swelling & ecchymosis
- Sublingual haematoma
- Abnormal bony crepitus, and mobility on functioning
- Visible and palpable deformity of the lower border of the mandible
- Paresthesia /Anesthesia of the lower left lip and chin (cranial nerve V_3)
- No obvious facial nerve (VII) weakness

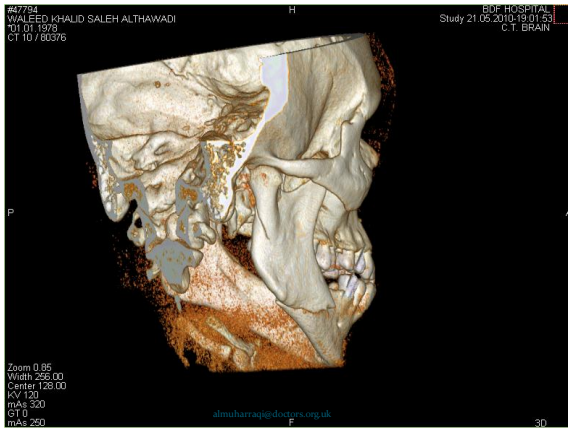
Radiographic Studies – 'Mandibular Series'

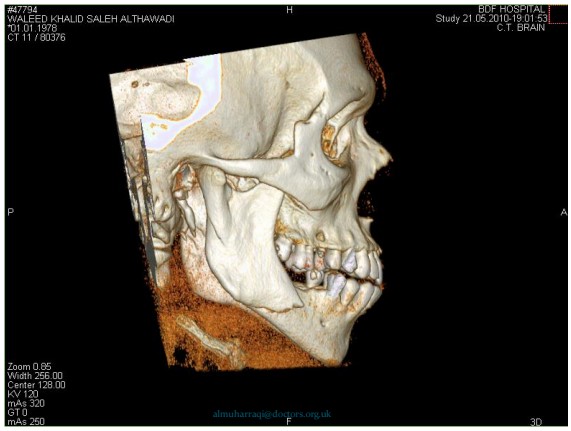
- Posterior-anterior mandibular views (PA)
- Orthopantamogram (OPG) – if an OPG is unavailable, lateral oblique mandibular views
- For more definitive imaging, a computerized tomographic (CT) scan with axial cuts ranging from 5 mm to 1.5 mm
- An open-mouth reverse Towne's view is included in these series if there is a condylar fractures

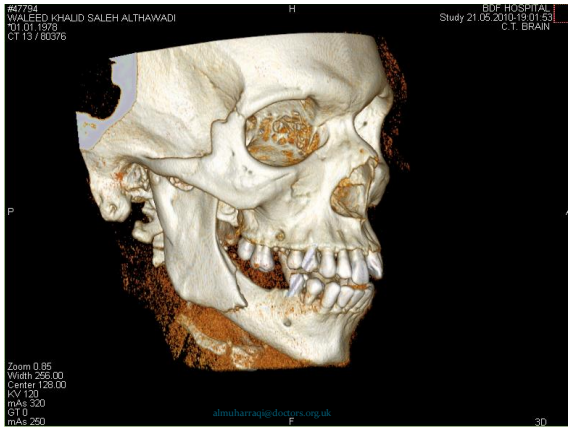
Case Presentation...

- Displaced, Compounded, Comminuted fracture of the anterior (symphysis) segment of the mandible extending through the left body and into the left body and ramus, Complicated with the left inferior-dental nerve and with teeth
- Displaced, Compounded fracture of the right body Complicated with the left inferior-dental nerve and with teeth
- Displaced, Compounded fracture of the right condylar neck (extra-capsular)





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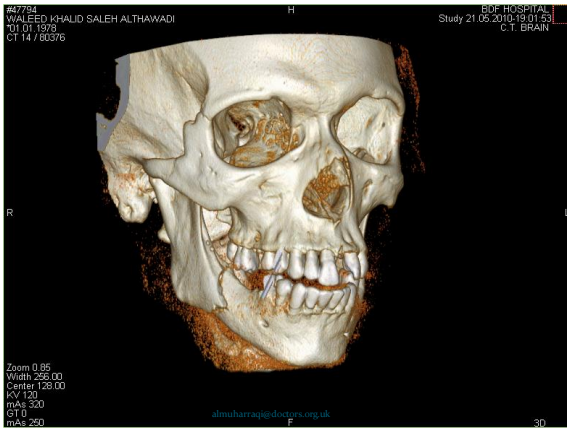
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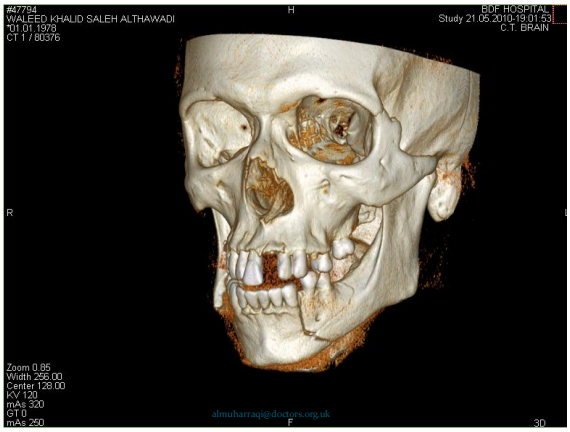
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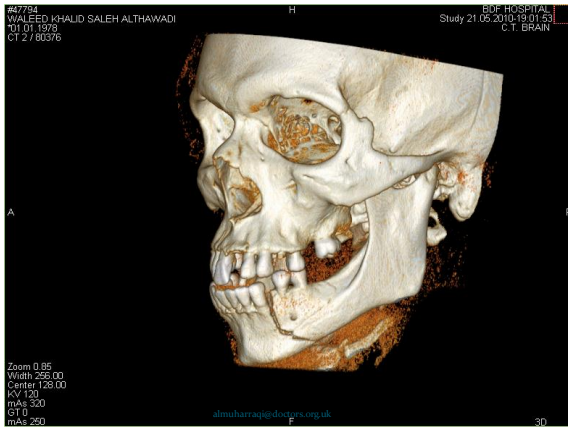
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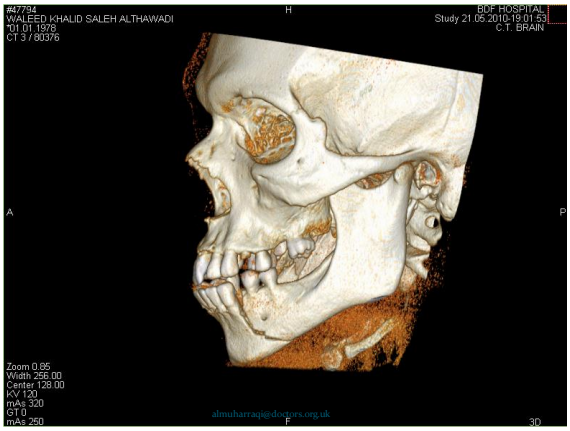
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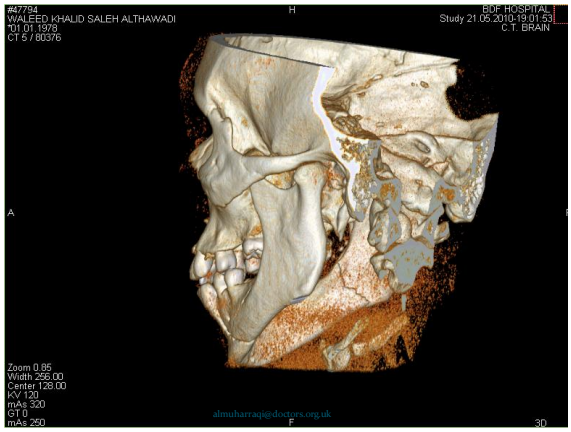

British Journal of Oral and Maxillofacial Surgery (2005) 43, 57–60

ELSEVIER

BRITISH Journal of Oral and Maxillofacial Surgery
www.bjoms.com

Transmasseteric antero-parotid approach for open reduction and internal fixation of condylar fractures

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Accepted 8 September 2004

KEYWORDS
Fracture;
Mandible;

Summary The morbidity that results from surgical approaches to the condylar neck, and the time-consuming nature of the operation inhibits many surgeons from using open reduction and internal fixation for the treatment of condylar fractures.

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doi:10.1016/j.jcms.2005.01.008, available online at http://www.sciencedirect.com

The periauricular transparotid approach for open reduction and internal fixation of condylar fractures

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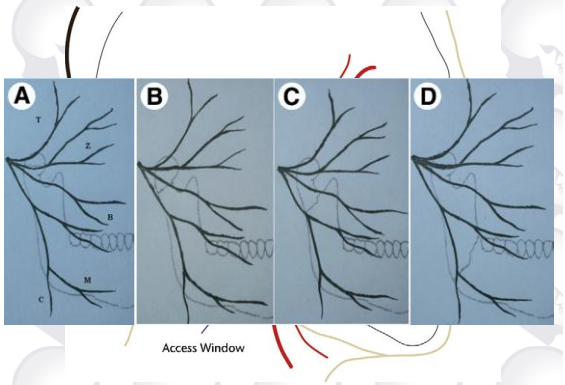
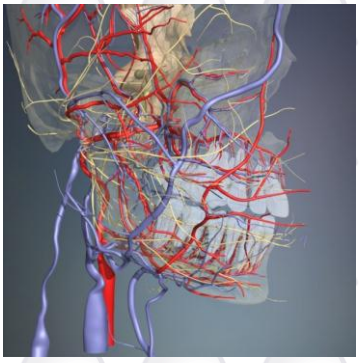
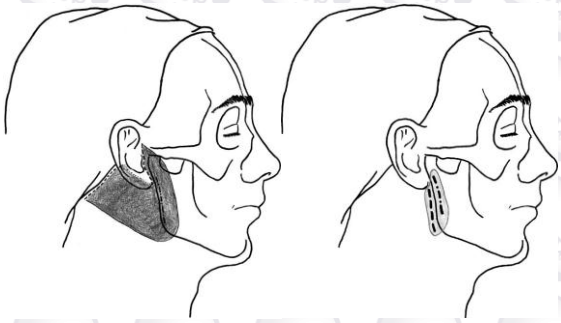
SUMMARY. Introduction: **Treatment of fractures of the mandibular condyle fractures varies among centres as there still is no general consensus. The aim of this paper was to determine the safety and efficiency of surgical treatment using a transparotid approach for direct plating.** Patients and methods: **A prospective clinical study was conducted on 34 patients with 36 fractures of the condyle. All 36 fractures were displaced, and 14 (39%) of them were fracture dislocations. The fractures were treated surgically with a transparotid facelift or retromandibular approach using miniplates and screws for fixation. Patients were carefully followed up and were asked to answer a survey paper 2–39 months postoperatively.** Results: **Occlusion practically identical to the pretraumatic condition was achieved in 31 out of 33 dentate patients (94%). Postoperative interincisal distance was 30–61 mm (mean 44 mm), 4 patients (12%) had postoperative deflection to the side of injury during mouth opening. Facial symmetry was achieved in all of the patients. Eight out of 36 cases (22%) had a transient weakness of certain ipsilateral facial muscle groups, lasting for 4–8 weeks. In one of these patients, a mild weakness of the upper lip and lower eyelid persisted after 13 months. There were 5 cases of miniplate fractures (14%), all of them in patients in whom 1.7 or thinner miniplates were used. There were 5 cases of salivary fistulae (14%), all of them in patients where the parotid capsule was not closed in a watertight fashion. According to the postoperative survey completed by 32 patients, 30 of them (94%) were very satisfied with the outcome of treatment.** Conclusion: **If conducted properly, the transparotid facelift approach offers a safe and effective approach for direct fixation of condylar fractures.** © **2005 European Association for Cranio-Maxillofacial Surgery**

Keywords: **Maxillofacial injuries; Condyle fractures**







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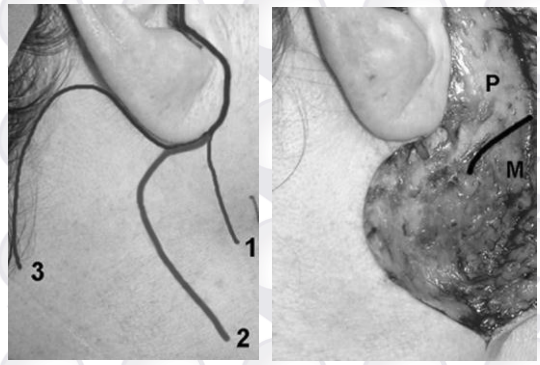

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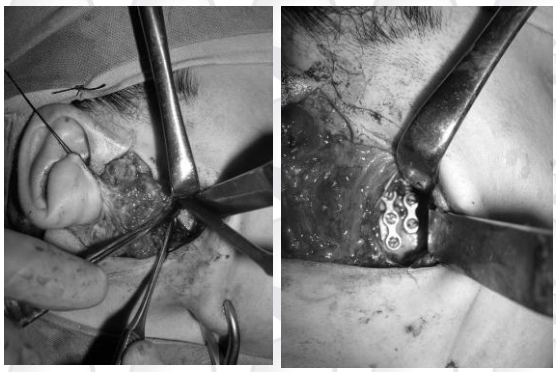

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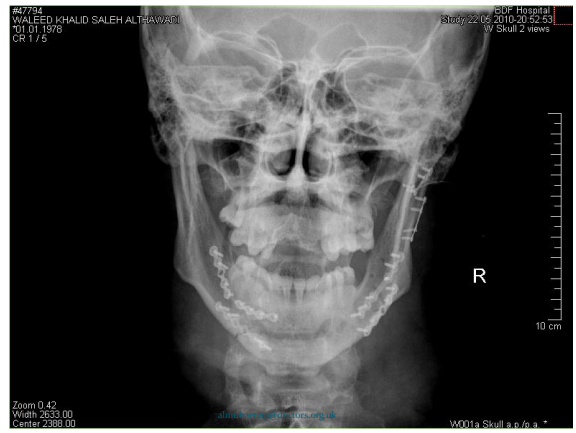

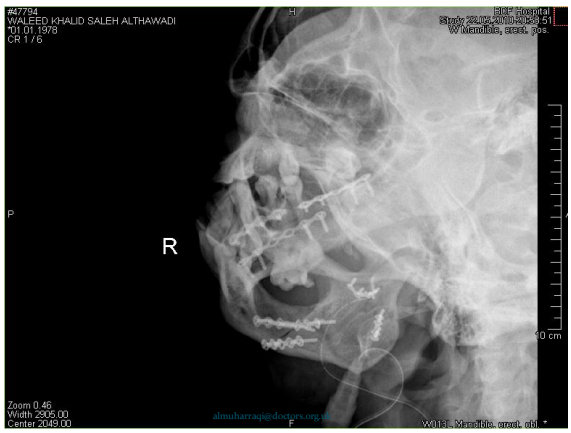

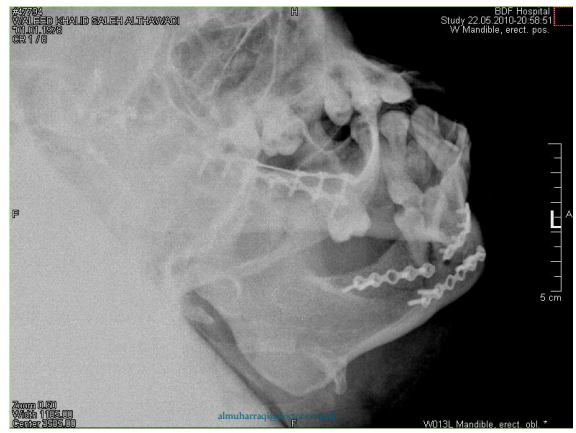

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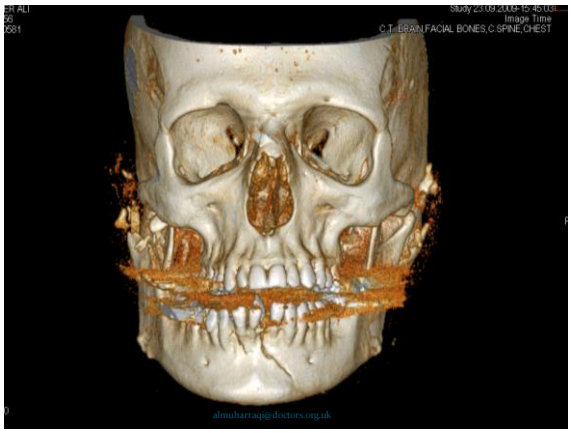

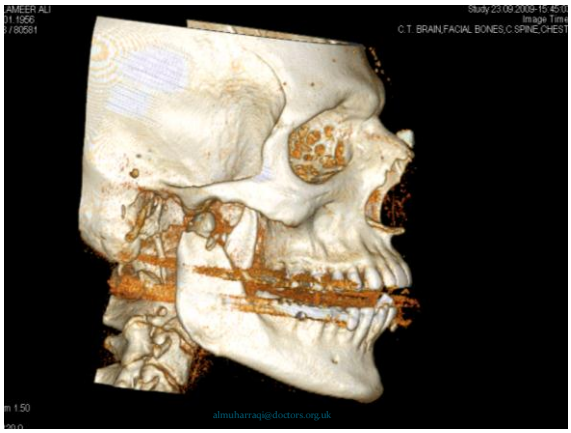

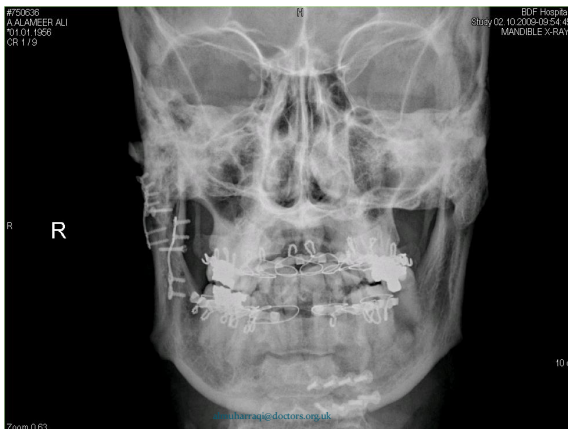

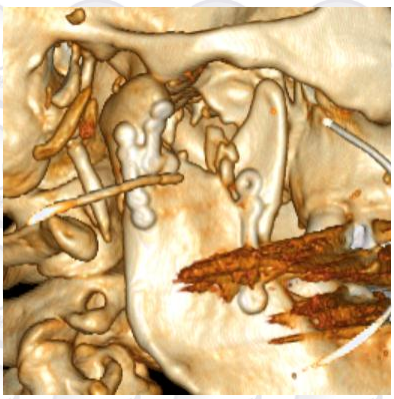

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Aims of Treatment

- The primary goals of mandibular fracture treatment are to restore:
  - continuity of the mandible
  - restore a patient's habitual functioning occlusion
  - maintain or re-establish acceptable facial and dental aesthetics
  - minimize neurosensory or facial nerve (CN VII) impairment.
  - maintain adequate nutritional status
  - minimize patient discomfort and inconvenience.

Treatment Considerations for Comminuted Mandibular Fractures (Ellis 3rd *et al* 2003)

- The use of open reduction and stable internal fixation (intra-oral approach and/or extra-oral approach) is associated with a low complication rate
- External pin fixation had a 35.2% complication rate compared with a 17.1% complication rate for closed treatment with MMF, and 10.3% with open reduction and stable internal fixation
- However, not all comminuted fractures are amenable to ORIF, and in those, alternatives such as closed reduction with MMF or the application of external pin fixation may be necessary

Timing of Treatment

- Not clearly defined
- The longer an open or a compound fracture is left untreated, the incidence of complications increases – Most are based on orthopedic literature (Lizuka *et al* 1991)
- Reduction **should be immediate unless** – patient has other more serious or life-threatening injuries

Post-op Antibiotic Prophylaxis in Mandibular Fractures

- The use of post-operative oral antibiotics in **uncomplicated** fractures of the mandible had no benefit in reducing the incidence of infections (Abubaker *et al* 2001 – **1b** SoE Level)
- No statistically significant benefit to the administration of post-operative antibiotics in patients undergoing **ORIF of mandibular fractures** (Miles *et al* 2006 – **1b** SoE Level)
- A 1-shot or 1-day administration of prophylactic antibiotics showed best results in reducing infections in mandibular fractures (Andreasen *et al* 2006 – **1a** SoE Level)

Long-term Complications of Mandibular Fracture Repair

(Furr *et al* 2006 – 2b SoE Level)

- The development of infection, nonunion, and related complications after the repair of mandibular fractures correlates with a history of: tobacco and alcohol use and ORIF of multiple fractures
- There were no statistically significant relationships to patient demographics (age, sex, location), etiology of fracture, fracture site, lag time to repair, length of hospitalization, or the use of antibiotics
- Antibiotic therapy appears to have had NO impact on the development of postoperative complications

...In Conclusion

- PA mandible and an OPG are the gold standard (CT scan justifiable in special cases only)
- Open reduction & stable internal fixation of the fractured mandible is associated with low complications
- 1-shot or 1-day administration of prophylactic antibiotics is recommended
- If conducted properly, the transparotid approach offers a safe and effective approach for direct fixation of condylar fractures

True Eminectomy (Eminoplasty) in Patients with Internal Derangement Of The TMJ

Introduction

- Internal derangement (ID) is the most common arthropathy of the temporomandibular joint (TMJ)
- Surgical intervention in ID:
  - presence of pain
  - structural alteration that is amenable to surgical correction
  - dysfunction that impairs ability to carry out normal function
  - failed to improve with non-surgical therapy
- Incidence of surgical treatment for ID of the TMJ range from 1% to 25%. Most authors report 5% of require it

Surgery for Internal Derangement

Surgery *without* Disk Repositioning

a. Arthrocentesis
b. Arthroscopic lysis & lavage
c. Arthroplastic release of adhesion with temporary silastic implant
d. Eminectomy
e. Diskoplasty (recontouring)
f. Modified condylotomy

Surgery *with* Disk Repositioning

a. Arthroscopic disk repositioning
b. Disk Plication
c. Diskopexy
d. Diskectomy without replacement
e. Diskectomy with replacement (dermis, cartilage, fascia, temporalis, *etc.*)
f. Eminectomy

Rationale for Eminectomy

- Originally described for habitual dislocation of the TMJ (Myrhaug *et al*, 1951)
- Suggested for recurrent 'Closed Lock' (Nitzan & Dolwick, 1991)
- Used for Internal Derangement of the TMJ (Weinburg et al, 1984)
- Was modified to remove the physical barrier to the articular disk – effectively decompressing the inter-capsular space (Stassen *et al*, 1991)

Rationale for Eminectomy

- Reported to be effective in correcting mechanical instability in Internal Derangement (Kerstens *et al*, 1984)
- Increases joint space (Williamson *et al*, 2000):
  - decompressing the irritated disc
  - allowing it to assume a more favourable disc – eminence - condyle relation,
  - without damaging the unique structure of the condylar head

Anatomy Recap

- Rests in the glenoid fossa, with considerable variations in dimensions
- Collagenous articular disc (intracapsular meniscus)
- Zones of the meniscus (Rees *et al*, 1954)
  - Posterior band – attached to fossa & condyle
  - Anterior band – attached to superior head of Lat. Pterygoid
  - Intermediate band
- Innervated by the masseteric & auriculo-temporal branches of V_3

Rationale for Eminectomy

- Shallow Fossa (low angle) – action of temporalis and masseter in mouth closing results in a postero-superior force on the anterior part of the posterior band
- Deep Fossa (steep angle) – effect of the forces are directed more posteriorly to the posterior band (bilaminar zone) causing anterior displacement of the disc and Internal Derangment
- Therefore reducing this 'steep angle' decompresses the inter-capsular compartment by creating a larger anterior recess in the superior joint space

British Association of Oral & Maxillofacial (BAOMS) Conference, London 2005

M A Al-Muharraqi, P M McLoughlin

A prospective study to assess the short and medium term outcomes of true eminectomy in patients with internal derangement of the TMJ where conventional conservative treatment had failed to resolve their symptoms

Patients and Methods

- 26 patients with advanced stage ID of the TMJ
- All treated with 'true' eminectomy after 1-year of failed non-invasive conservative treatment
- Symptoms: chronic severe pain, moderate to severe limitation of mandibular movement, bothersome joint noises
- Supported by MRI evidence of late stage disc displacement - all subjects in this study were diagnosed with disc displacement with and without reduction and with and without limited mouth opening
- Of the 26 patients – 44 joints had surgery, with 18 bilateral cases (3 left & 5 right). There were 11 ♂ and 15 ♀ with an age range of 20 - 52 (mean 35 years)
- All patients had a complete dentition

Clinical Evaluation

- Subjective Evaluation:
  - Mandibular Functional Impairment Questionnaire (MFIQ)
- Objective Evaluation:
  - Maximal Mouth Opening - Inter-Incisal Distance (IID)
  - MRI Staging of Internal Derangement of the TMJ

Mandibular Function Impairment Questionnaire (MFIQ)

- The MFIQ was developed by Stegenga *et al*, in 1993
- A 17-item questionnaire divided into – masticatory activities and non-masticatory activities
- Each item is in the form of a 5-point Likert scale
- Patients indicate to what extent they had difficulties in doing that task (0 = no difficulty, to 4 = extreme difficulty / impossible without assistance)
- The MFIQ questionnaire reliably assesses the degree of impairment of specific jaw functions without measuring symptoms and signs causing the functional impairment

Inter-Incisal Distance (IID)

- Maximal, unassisted clinical mouth opening between incisor teeth before and after eminectimy was recorded
- Without overbite compensation

Staging of internal derangement of the TMJ

- Clinical signs & symptoms and MRI were used to classify the internal disc derangement, with emphasis on clinical findings.
- MRI was considered as a golden standard to evaluate the disc position (Gibbs *et al*, 1998)
- Clinically, the internal derangement was based on Wilke's (1987) Staging
- Patients were pre-assessed by a psychiatrist to rule out psychological distress, specifically depression, anxiety, and the presence of non-specific physical symptoms reflecting somatization tendencies

Results

- All Patients were followed up for at least 1-year
- MFIQ – out of 26 patients
  - In 5 : the score reduced from a preoperative 3 (out of 4) to 0
  - In 19 : the score reduced from a preoperative 3 to 1
  - In the remaining 2 it improved to 2
- IID
  - In 90% of patients had an increased maximum mouth opening one year postoperatively (range 10-20 mm, mean 15 mm)
  - A statistically significant result using a paired t test ($p < 0.001$)
  - The maximal unassisted clinical mouth opening between the incisor teeth before and after operation was significantly greater in all but two patients
- MRI
  - MRI showed increase in rotation and translatory movement of the condylar head
  - Findings consistent in all cases where the MRI was adequately clear for analysis

Discussion

- IID:
  - A statistically significant result using a paired t test ($p < 0.001$).
- MFIQ:
  - This subjective assessment is a simple tool for assessment of improvement of TMJ function
  - The results confirmed a significant reduction of impairment of TMJ functions
- MR imaging was used to confirm internal disc derangement, which was reduced in all cases after true eminectomy
- The patients were not only happy with their restored function, but also the lack of any obvious postoperative scar

Conclusion

'True' eminectomy may be used to effectively treat advanced stages of internal derangement in cases which have failed to respond to non-invasive conventional treatment

Total Joint Replacement (TJR) in the Tmporomandibular Joint (TMJ)

Alloplastic Joint Replacement

FACT.!!

The practice of modern orthopaedic surgery would be unthinkable without the availability of alloplastic replacement devices

Alloplastic Joint Replacement

A Biomechanical Answer Rather Than a Biological Solution To The Management of Severe and Debilitating Anatomical TMJ Disease

These are Salvage, End-stage Devices for the Surgically and/or Pathologically Mutilated Joint

Goals of TMJ Replacement

1. Improve Function and Form
2. Reduce Suffering
3. Contain Excessive Treatment
4. Contain Further Cost
5. Prevent Further Morbidity

Mercuri LG. **Alloplastic temporomandibular joint reconstruction.** Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998 Jun; 85(6):631-7.

Indications for total replacement of the TMJ

- Prerequisite: Failed conservative management (including arthroscopy if possible).
- Diagnosis: Computed tomogram or magnetic resonance scan as a minimum (not just plain radiographs).

Sidebottom AJ; UK TMJ replacement surgeons; British Association of Oral and Maxillofacial Surgeons. **Guidelines for the replacement of temporomandibular joints in the United Kingdom.** Br J Oral Maxillofac Surg. 2008 Mar;46(2):146-7. Epub 2007 Jan 16.

Indications for total replacement of the TMJ

- Diseases involving condylar bone loss:
  1. Degenerative joint disease (osteoarthrosis) *not* responsive to other modalities of treatment
  2. Inflammatory joint disease (e.g rheumatoid, ankylosing spondylitis, psoriatic) *not* responsive to other modalities of treatment
  3. Ankylosis *not* responsive to other modalities of treatment
  4. Post-traumatic condylar loss or damage
  5. Postoperative condylar loss (including neoplastic ablation)
  6. Previous prosthetic reconstruction (failed alloplastic graft)
  7. Previous costochondral graft (failed tissue graft)
  8. Serious congenital deformity
  9. Multiple previous procedures

Sidebottom AJ; UK TMJ replacement surgeons; British Association of Oral and Maxillofacial Surgeons. **Guidelines for the replacement of temporomandibular joints in the United Kingdom.** Br J Oral Maxillofac Surg. 2008 Mar;46(2):146-7. Epub 2007 Jan 16.

Indications for total replacement of the TMJ

- Clinical Indications (a combination of the following):
  1. Dietary score of <5/10 (liquid scores 0, full diet scores 10)
  2. Restricted mouth opening (<35 mm)
  3. Occlusal collapse (anterior open bite or retrusion)
  4. Excessive condylar resorption and loss of height of vertical ramus
  5. Pain score >5 out of 10 on VAS (combined with any of the others)
  6. Other quality of life issues

Sidebottom AJ; UK TMJ replacement surgeons; British Association of Oral and Maxillofacial Surgeons. **Guidelines for the replacement of temporomandibular joints in the United Kingdom.** Br J Oral Maxillofac Surg. 2008 Mar;46(2):146-7. Epub 2007 Jan 16.

Contraindications

1. Age?
2. Uncontrolled para-functional habits?
3. Local infective process
4. Severe immunocompromise
5. Severe coexistent diseases (American Society of Anesthesiologists Grade III)
6. Psychosis

Sidebottom AJ; UK TMJ replacement surgeons; British Association of Oral and Maxillofacial Surgeons. **Guidelines for the replacement of temporomandibular joints in the United Kingdom.** Br J Oral Maxillofac Surg. 2008 Mar;46(2):146-7. Epub 2007 Jan 16.

Indications for the Use of Various Modalities for TMJ Reconstruction

Condition	Autogenous	Alloplast	Engineered ‡
Inflammatory Arthritis	+*	+++	+*
Ankylosis	+	+++	+++
Failed Autogenous Graft		+++	+++
Failed Alloplast		++	++
Loss of Vertical Height	++†	++	++*

**JRA, juvenile rheumatoid arthritis.*

†Growing children.

‡Future potential after further in vitro and in vivo studies

Mercuri LG: TMJ Reconstruction. In, **Fonseca's Oral and Maxillofacial Surgery.** Chapter 51. Elsevier, Philadelphia. 2008.

Targeted Assessment of the TMJ in Patients with Rheumatoid Arthritis

Study:

- 61 RA patients recorded signs and symptoms of TMJ pain and dysfunction.

Results:

- 70.5% reported at least 1 symptom; 51% had at least 1 sign.

Conclusion:

- A significant percentage of RA patients have signs and symptoms of TMJ involvement and measurement of mandibular range of motion proved to be an important measurement tool.

Bessa-Nogueira RV, Vasconcelos BC, Duarte AP, Góes PS, Bezerra TP. **Targeted assessment of the temporomandibular joint in patients with rheumatoid arthritis.** J Oral Maxillofac Surg. 2008 Sep;66(9):1804-11.

The Impact of Total Joint Replacement In Rheumatoid Arthritis

Device objective performance and patient subjective and objective evaluations provided evidence that the pre-operative status of the joint *determines* the extent of post-operative functional gain.

Therefore, postponing TJR for too long will result in less functional benefit.

Nelissen RG. **The impact of total joint replacement in rheumatoid arthritis**. Best Pract Res Clin Rheumatol. 2003 Oct;17(5):831-46

Inflammatory Arthritis of the TMJ is *not* Responsive to other Modalities of Treatment

Autogenous vs. Alloplastic TMJ Reconstruction in Rheumatoid-Induced TMJ Disease

Conclusion:

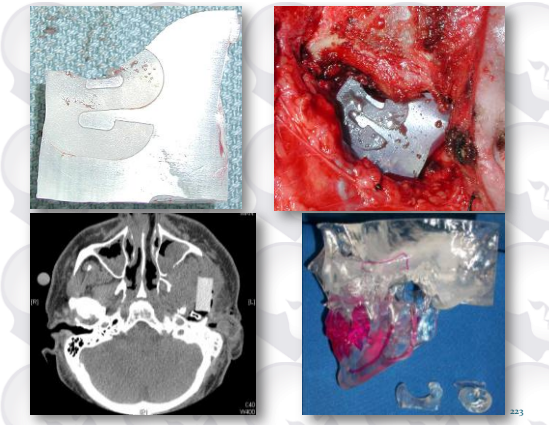
- Alloplastic prostheses provided statistically significant better subjective and objective results than did autogenous tissue for the reconstruction of the TMJs of patients with rheumatoid arthritis

Further:

- Alloplastic prosthetic reconstruction eliminates donor site morbidity, reduces OR time, and permits mandibular advancement to be simultaneously performed with excellent long term stability.

Freitas, RZ; Mehra, P and Wolford, LM. **Autogenous vs. Alloplastic TMJ Reconstruction in Rheumatoid-Induced TMJ Disease.** J Oral Maxillofac Surg 58:43-44,2000

Recurrent Fibrous and/or Bony Ankylosis *not* Responsive to other Modalities of Treatment



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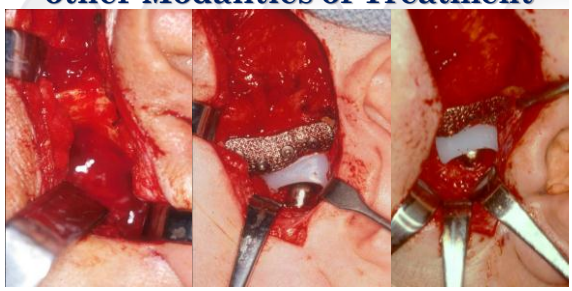
Recurrent Fibrous and/or Bony Ankylosis *not* Responsive to other Modalities of Treatment



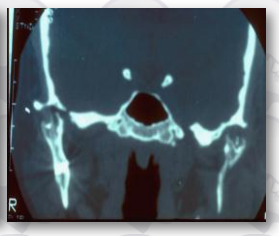
Autogenous Fat Graft

- Total alloplastic replacement with a patient fitted prosthesis appears to provide a safe and effective management for patients with re-ankylosis of the TMJ.
- Autogenous fat transplantation appears to be a useful adjunct as its use appears to minimize the re-occurrence of joint heterotopic calcification, consequently providing improved and consistent range of mandibular motion over time.

Mercuri LG, Alcheikh Ali F, Woolson R: **Outcomes of Total Alloplastic Replacement with Peri-Articular Autogenous Fat Grafting for Management of Re-ankylosis of the TMJ**. J Oral Maxillofac Surg 66:1794-1803, 2008

What's the Evidence with Failed Autogenous Tissues?

Failed Auricular Cartilage Graft



Failed Costochondral Graft

A Retrospective Study of the Costochondral Graft in TMJ Reconstruction

57 patients 76 costochondral grafts

2 years follow-up

- In patients with failed alloplastic discs and/or total joints, the results were less predictable.
- A preoperative diagnosis of ankylosis was associated with a high complication and surgery rate suggesting caution in this group of patients.

Saeed NR, Kent JN. **A retrospective study of the costochondral graft in TMJ reconstruction.** Int J Oral Maxillofac Surg. 2003 Dec;32(6):606-9.

Reconstruction of the Temporomandibular Joint Autogenous Compared with Alloplastic

49 patients - costochondral grafts

50 patients – alloplastic total joints

2 years follow-up

- Patients in both groups showed an improvement,
- but more patients required re-operation in the autogenous group.

Saeed, NR; Hensher, R; McLeod, N; Kent, JN. **Reconstruction of the Temporomandibular Joint Autogenous Compared with Alloplastic.** Br J Oral Maxillofac Surg 32: 606; 2003

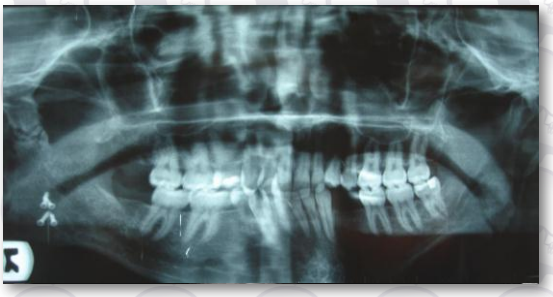
Follow up of Mandibular Costochondral Grafts After Release of Ankylosis of the TMJ

55 patients - 25 unilateral/ 30 bilateral

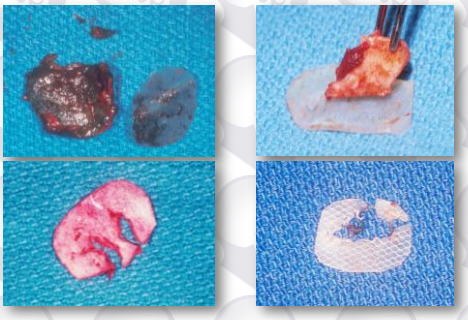
7 – 10 years follow-up

- 59% good remodeling; 25 % resorbed; 9% re-ankylosed; 4% overgrowth
- 58% satisfactory MIO
- 18% unsatisfactory MIO
- 24% failure

Medra AM. **Follow up of mandibular costochondral grafts after release of ankylosis of the temporomandibular joints.** Br J Oral Maxillofac Surg. 2005 Apr;43(2):118-22



Failed Alloplastic TMJ Reconstruction



Proplast-Teflon Silastic

Treatment Outcomes for TMJ Reconstruction after Proplast-Teflon Implant Failure

Conclusion

- Alloplastic devices provides better functional and occlusal results than do autogenous tissues in patients requiring total TMJ reconstruction after failed Proplast-Teflon implants.

Henry CH, Wolford LM. **Treatment outcomes for temporomandibular joint reconstruction after Proplast-Teflon implant failure.** J Oral Maxillofac Surg. 1993 Apr;51(4):352-8; discussion 359-60.

Conclusion

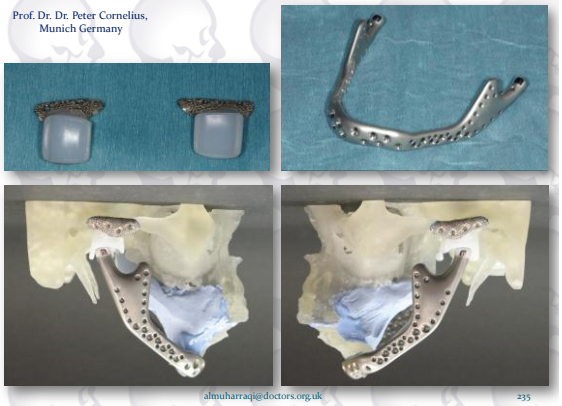
A Total Alloplastic TMJ reconstruction device, appropriately designed and tested, manufactured with biologically compatible materials, and implanted properly is a ***safe*** and ***effective*** management modality in indicated cases.

TMJ Prosthesis Devices

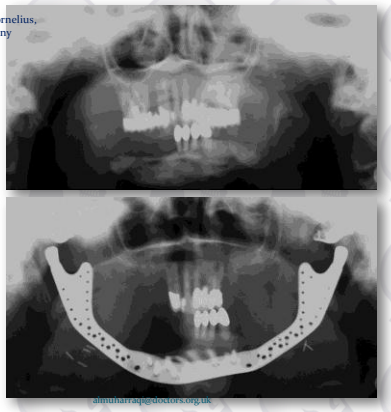
	TMJ Implants	TMJ Concepts	Biomet/Lorenz
Fossa	Co-Cr-Mo alloy	Titanium (UHMWPE surface)	UHMWPE
Condyle	Co-Cr-Mo alloy	Co-Cr-Mo alloy	Co-Cr-Mo alloy (titanium surface)
Ramus	Co-Cr-Mo alloy	Titanium alloy	Co-Cr-Mo alloy
Screws	Fossa: 3–4 (2.0 mm); Ramus: 6–8 (2.7 mm)	Fossa: 3–4 (2.0mm); Ramus: 7–10 (2.0 mm)	Fossa: 4–7 (2.0 mm); Ramus: 7–11 (2.7 mm)
Type of joint	Stock prosthesis (30 fossa; 3 condyle–ramus)	Custom CAD/CAM prosthesis	Stock prosthesis (three fossa; three condyle–ramus)

Co: cobalt; Cr: chromium; Mo: molybenum; UHMWPE: ultra-high molecular weight polyethylene.

Prof. Dr. Dr. Peter Cornelius, Munich Germany



Prof. Dr. Dr. Peter Cornelius, Munich Germany



What's the Evidence it Works?

Clinical studies	No. of TMJs	Case selection	Follow-up period	Main findings	Manufacturer	Success rate
Chase et al., (1995)[7]	34	Not responsive to prior surgical or conservative therapies	2.4 years	Significant improvement	TMJ Implants	100% success rate (patients)
Mercuri et al. (1995)[10]	363	Ankylosed, degenerated or resorbed joints Failed autogenous bone or soft-tissue grafts Destruction of an autogenous graft as the result of previous pathology Failed Vitek Proplast-Teflon interpositional implants Failed Vitek fossas and/or condyles, or other alloplasts (i.e. silicone rubber) or other total or partial joint prostheses Severe inflammatory disease (i.e. rheumatoid arthritis, psoriatic arthritis, etc)	13.6 months	Significant improvement	TMJ Concepts	91% success rate (patients)
Mercuri, (1999)[20]	363	Multiply operated Anatomically mutilated Functionless Chronic pain	30.7 months	Subjective improvement higher in patients with less than 2 previous surgeries Objective improvement higher in multiply operated patients	TMJ Concepts	No data on success rate and drop outs
Speculand et al. (2002)[26]	86	Degenerative arthropathy or osteoarthritis ($N = 33$) Rheumatoid arthritis and ankylosis ($N = 10$) Injury ($N = 5$) Ankylosis ($N = 5$) Ankylosis and asymmetry after resection for cancer ($N = 2$) Fibrous ankylosis ($N = 2$) Worn Kent VK II prostheses ($N = 2$) Psoriatic arthritis ($N = 1$) TMJ dysfunction ($N = 2$)	14.5 months	TMJ Implants prosthesis gave better results than Vitek VK II (no longer available)	TMJ Implants vs. Vitek VK II	100% success rate for TMJ Implants vs. 89% for Vitek VK II (joints)

Mercuri et al. (2002)[24]	97	Trauma ($N = 28$) Intraricular TMJ pathology ($N = 8$) Systemic arthritis ($N = 6$) Developmental skeletal abnormalities ($N = 4$) Unknown etiology ($N = 12$) Prior unsuccessful TMJ implants (Proplast-Teflon or Silastic) had been performed in 35 subjects	107.4 months	Significant improvements (mail questionnaire) Subjective improvement (pain) higher in subjects with less than 2 previous surgeries	TMJ Concepts	58 out of 215 patients of the 1995 study (27%)
Saeed et al. (2002)[24]	68	Degenerative joint disease ($N = 10$) Rheumatoid arthritis ($N = 6$) Internal derangement ($N = 15$) Trauma ($N = 12$) Congenital disease ($N = 1$) Other ($N = 6$)	43 months	TMJ Implants prosthesis gave better results than autogenous costochondral grafts for both subjective and objective parameters	TMJ Implants	88% success rate for TMJ Implants (6/50 patients requried re-surgery) vs. 63% for autogenous grafts (18/49 patients required re-surgery).
Wolford et al. (2003)[68]	78	Multiply operated TMJs (>2 previous operations) Previous TMJ alloplastic implants containing Proplast/Teflon, Silastic, acrylic, or bone cements Inflammatory, infective, reactive, or resorptive TMJ pathology Connective tissue or autoimmune disease (ie, rheumatoid arthritis, psoriatic arthritis, scleroderma, Sjogren's syn drome, lupus, ankylosing spondylitis, etc) Fibrous or bony ankylosis Absence of TMJ structures due to Pathology, trauma, or congenital deformity Tumors	20.8 months TMJ Implants 33 months TMJ Concepts	TMJ Concepts prosthesis patients improved more than TMJ Implants TMJ Implants had a higher number of previous surgeries (un-matched samples)	38 TMJ Concepts 40 TMJ Implants	No data on success rate and drop outs

Wolford et al. (2003)[69]	69	The same than Wolford et al (2003)[68]	73.5 months	Significant improvements Patients with fewer surgeries and without exposure to Proplast-Teflon or Silastic implants improved most	TMJ Concepts	10% drop-out rate 84.2% success rate (6/38 patients required re-surgery)
Mercuri and Giobbie-Hurder (2004)[33]	332	Proplast-Teflon ($N = 135$) Silastic ($N = 46$) Both ($N = 46$) None ($N = 105$)	60.2 months	All functional Patients with six or more previous surgeries reported poorer improvement	TMJ Concepts	100% success rate 12% drop-out rate

Anticipate Rapid Response

Biomet Microfixation

Patient Matched TMJ Implants

- Current Process
- Capabilities

Innovate

Anticipate Rapid Response

Basic Design

- **Cobalt-chromium mandibular component** w/ titanium plasma spray (entirely titanium for patient w/ nickel allergy or large resection)
- **Ultra-high molecular weight polyethylene** (UHMWPE) fossa component
- Same materials and articulating surfaces as stock TMJ implants

Innovate

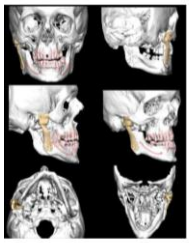
Anticipate Rapid Response

Process

- Typically takes 2 months from request to surgery
- Can be reduced to 3 weeks w/ excellent communication

Innovate

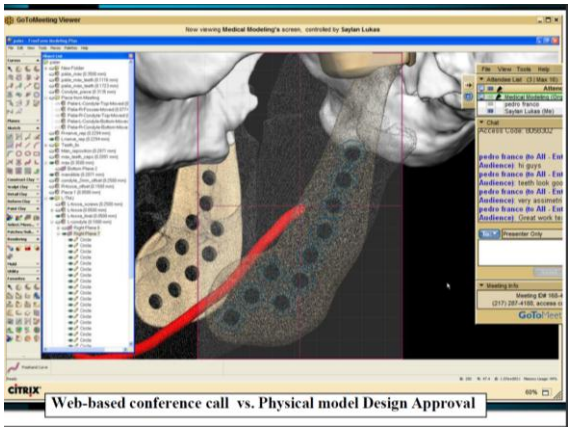
Anticipate Rapid Response



1. **Scan Patient** (Reference CT Scanning Protocol)
2. **Send CT data to Medical Modeling** (Reference FTP uploading directions)
3. **Images of anatomical rendering** sent by BMF/MM for surgeon reference
4. **Design inputs and prescription** are filled out by Surgeon and sent to BMF
5. Images of osteotomies and **initial design** are sent to surgeon
6. **Design analysis** (via Web-based conference call or physical models)

6a. If changes are needed, specific modifications or additions are communicated to BMF

Innovate

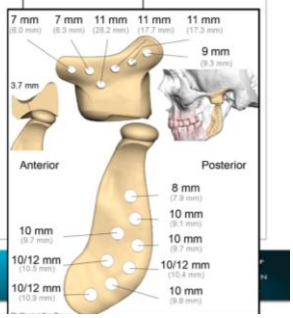


Web-based conference call vs. Physical model Design Approval

7. **Design Approved**
8. Case date and pricing are finalized
9. Purchase Order Obtained
10. **BMF begins manufacturing process** (5 weeks minimum is required from the approval date until surgery)
11. **Implants, models, burring/cutting guides and screw length chart are shipped** (at least 1 week prior to surgery date)
12. ClearView Model and Burring Guides Sterilized by hospital (Sterrad)

SURGERY

6b. BMF modifies design and resends images or physical models (additional web-based conference call may be arranged if needed)



Innovate

Adverse Outcomes

Adverse outcomes 1999–2006. (Table from Professor LG Mercuri and TMJ Concepts, and reproduced with permission. Presented at the New York University College of Dentistry, 25 August, 2007.)

Adverse outcome	Number	Percentage ofdevices supplied to end of 2006 ($n = 3285$)	Percentage of cases to end of 2006 ($n = 2106$)
Infection	44	1.34	2.09
Operative difficulties	23	0.73	1.14
Malocclusion/malposition/displaced	19	0.58	0.90
Pain, swelling, or irritation	19	0.58	0.90
Dislocation	14	0.43	0.66
Heterotopic bony/scarred tissue formation	11	0.33	0.52
Exploratory operation	8	0.24	0.38
Sensitivity to material	7	0.21	0.33
Fractured component	7	0.21	0.33
Fracture of bone screw	6	0.18	0.28
Dehiscence or performation	6	0.18	0.28
Loosening of component	2	0.06	0.09
Mishandling	1	0.03	0.05
Totals	170	5.18	9.03

Temporomandibular Joint Total Replacement Prostheses: Current Knowledge and Considerations for the Future

1. TMJ TJR have shown promising outcomes. Reported improvements are good for both subjective and objective parameters, worthy of further evaluation.
2. Future larger sample size studies are needed to confirm the current data and demonstrate the superiority of TMJ TJR over less invasive modalities.
3. Better integration of clinical and research settings for better understanding of indications, possibly increasing them

Guarda-Nardini L, Manfredini D, Ferronato G. **Temporomandibular joint total replacement prosthesis: current knowledge and considerations for the future.** Int J Oral Maxillofac Surg. 2008 Feb;37(2):103-10. Epub 2007 Nov 19.

Thank You