

Internal derangement of temporomandibular joint: Umbrella perforated screw technique

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ABSTRACT

Introduction: Umbrella shaped Perforated Screws (UPS) were developed for the use of orthopedic surgery to facilitate anchoring and fixation of the tissue to bone. We here present a retrospective study of Temporomandibular joint Internal derangement (ID) with fixation using this type of screws. **Materials & Methods:** We conducted a retrospective study including patients treated for ID using UPS to reposition the articular disc. The study included patients treated between 1998 and 2005. Patients were selected in concordance with clinical symptoms and signs of severity. All patients had an MRI (open/closed mouth) to confirm the diagnosis. Wilkes classification of temporomandibular disease (TMD) was adopted in the selection criteria. **Results:** Hundred and five patients were included, 92 female and 13 males with average age of 37.56. Dentists or general physicians mainly addressed these patients to our unit. The mean time from symptoms initiating to first consultation was 3.77 years, while the mean timing of surgery after initial consultation was 9.38 months. Patients have presented with various symptoms before the surgery including pain, limitation in eating habits and clicking. 77% of the patients had no or minimal pain post surgery. Hundred and one patients had good eating habits after surgery. Only 34 patients had persistent clicking despite surgery. We had neither infection nor hematoma as complication. Major complication to this technique is frontal paresis (14 patients), which was explained to all patients preoperatively. This paresis recovered in less than 2 months in all patients. We had 89.5% of the patients satisfied with their results. **Conclusion:** UPS are useful in the field of plastic surgery. This novel technique has the advantage of not compromising the vascular supply of the TMJ articular surface. This technique provides a simple, fast and efficient technique for posterior aponeurosis flap fixation. Our overall satisfactory rate was comparable to other studies.

Keywords: Articular disc, condylotomy, occlusion

Introduction

Internal derangement (ID) is considered the most common cause of Temporomandibular joint (TMJ) disease and dysfunction (TMD) and therefore they are most likely to be treated surgically. It occurs more commonly in females.^[1] Treatment is mainly to relieve pain and other symptoms. Early surgical consultation is important to delay progression of the

disease.^[2] Open joint procedures have shown to have good prognosis. Here, we introduce a new modified simple technique to approach and reposition the articular disc. TMJ internal derangement is a disease that can be encountered by primary care physicians. In our statistics, majority of the patients were referred to us by general physicians, and delayed treatment can result in surgical intervention rather the simpler, more conservative treatment which includes splinting.

In this study we have reviewed the literature on different modalities of treatment. The goal of this study is to evaluate the benefits of this repositioning and fixation method in patients with ID.

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Materials and Methods

The Institution Review Board approved this study. Ethical measures were considered and permission by the review board was granted. So, we conducted a retrospective study including the patients diagnosed with internal derangement (ID) of the temporomandibular joint. We have recruited these patients through the review of the clinical charts in our institute from 1998 to 2005. We had 105 patients with ID who were evaluated before and after surgery. These patients were treated in our institute between 1998 and 2005. All patients had been clinically examined for TMJ symptoms including pain, clicking, locking and headaches. Patients were interviewed to obtain information on satisfaction, and improvement of symptoms post-operatively. We have used an Umbrella shaped Perforated Screws (UPS) to surgically correct all ID in these patients. Two senior plastic maxillofacial surgeons evaluated all 105 patients by clinical examination and radiographic evaluation. Panoramic views and tomography were conducted in all patients to eliminate non-disc etiologies. These patients were treated meanwhile by different modalities of NSAID, analgesic and splinting before surgery is indicated. Surgery was indicated where expectant treatment was not sufficient for patients symptoms. If the surgery is decided by the surgeon, Magnetic Resonance Imaging (MRI) in two mouth positions (open and Closed) were always done to confirm the disc displacement. Various data were analyzed comprising age, gender, symptoms, and its duration, radiological evidence of ID, degree of ID, type of treatment (medical and/or surgical) and patients' satisfaction postoperatively. We further evaluated the patients on regular follow-ups to determine the efficiency of this treatment. A questionnaire was conducted to evaluate patients' symptoms of the disease. We also emphasized on determining the improvement, deterioration and/or persistence of signs and symptoms post operatively. The IRB approval was obtained in DIJON France, No.: CHU DIJON COTE D OR éthique 2005114X2.

Surgical Technique

The Surgery was carried out in the following sequence. The patient is first put into general anesthesia. Routine disinfection was made. We have used the same incision described by McCarthy and Farrar in 1979.^[3] A Hockey stick L-shape above and in front of the ear measuring 3 to 4 cm, it then extends downward preauricular measuring 4 to 5 cm until the inferior border of the ear lobule. To preserve the facial nerve branches; we dissect on the surface of the temporal fascia at the superior part of the incision until we reach the zygomatic arch. By that the temporomandibular region is fully exposed. A two-centimeter incision is made on the arch over the glenoid fossa [Figure 1]. Further inferior subperiosteal dissection is performed to access the superior joint space [Figure 2]. No dissection through the lower joint space is performed to preserve maximal condylar and disc vascularity. At this moment, the joint can be tested perioperatively if necessary. The disc shape, length and condyle were evaluated visually. Locking, clicks due to abnormal position of the disc can be identified and corrected afterwards. As per our inclusion criteria all patients had a confirmation of ID by

MRI, so the disc pathology included disc displaced internally and anteriorly. For that the superior interface of the disc was dissected and released from the adherence frequently present within the glenoid fossa. Once the disc is released from the adherence surfaces, it is correctly placed on the condyle. An Umbrella Shaped Perforated Screws (UPS) maintains this position. This Screw is 11 mm Long and 2 mm in diameter. The superior part of this screw is perforated, and composed of a hole for 2-0 non absorbable thread to pass [Figure 3]. As the disc is replaced and maintained in the correct position on the condyle a pilot hole is made through the disc; on its posterior-lateral surface. The UPS is inserted through the hole leaving the two extremities of the thread free. Then a temporofacial posterior aponeurosis flap is raised and rotated [Figure 4] to give more support. This flap is maintained on top of the disc by the two extremities of the thread. A needle suture will be placed on the nude extremity. Both threads are tied together, as they cover the full surface including the screw and leading to reinforce the posterior disc attachments. Occasionally and only as needed, additional sutures can be placed between the disc, capsule and temporal fascia in order to reinforce the position.

In the final step, protruding and retruding the mandible test the integrity of the disc and sutures. Closure of the soft tissues is completed in the usual manner. We use a drainage system for 24-48 hours. In cases of bilateral ID we usually operate both sides at the same time to provide a symmetric forces. If needed, panoramic view X-rays can be requested to verify the location of the screws [Figure 5].

Results

We reviewed 234 patients diagnosed with ID and treated with the technique described. These patients were diagnosed based on their symptoms, signs and radiological evidence of ID in accordance to the diagnostic criteria of Wilkes-Bronstein Classification of TMD.^[4] Only 105 patients were available for follow-up. Reason to include patients only in 1998-2005 was that adequate follow up was only possible during this period, and the principle surgeon has changed the country of residence and practice. We understand that this is a limitation to our study but we believe the findings of this study is valuable and the technique is innovative.

All patients underwent splint therapy for at least 3 months pre-operatively. Our sample included 92 female patients and 13 male. The sample age varied from 15 to 68 years old with a mean of 37.56 year old. The majority of the patients were addressed to our unit by their dentist or general physician. Symptoms pre-operatively varied from pain, limitation in eating habits, licking, dislocation or subluxation, locks and headaches. The duration between beginning of symptoms and first surgical consultation varied between 6 months to more than 10 years according to severity of symptoms.

In the routine follow up before and after the surgery we have interviewed the patients personally and clinical examination were



Figure 1: Preauricular incision to access the glenoid fossa

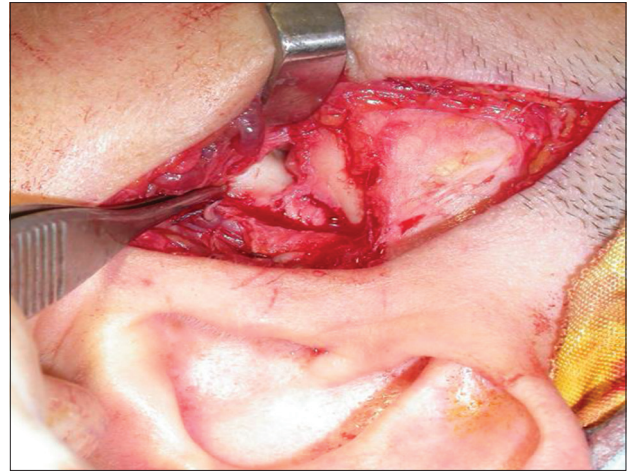


Figure 2: Dissection subperiosteally reaching the joint space

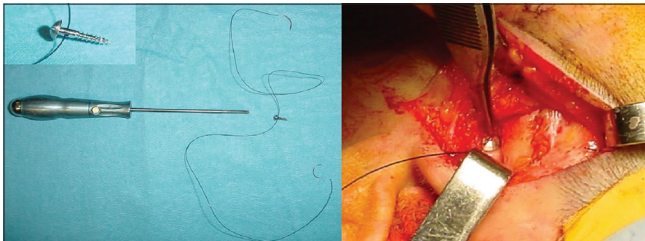


Figure 3: UPS screw used for disc replacement

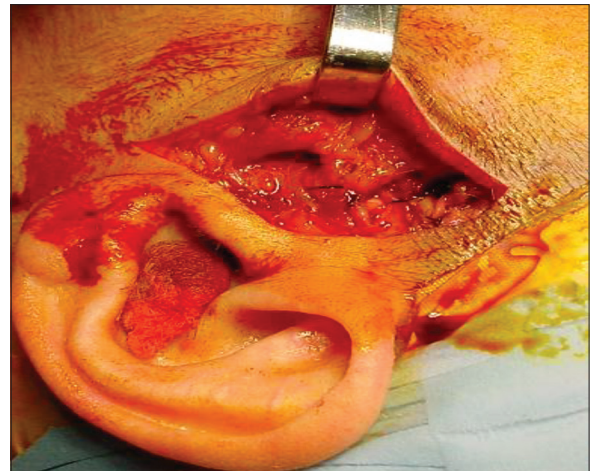


Figure 4: Posterior apponeurosis flap is used to cover the repair

conducted. The maximal opening, mandibular lateral mobility, pain and presence of clicking or locking were recorded during the clinical examination pre-operatively and post-operatively. In this interview we have asked the following questions:

- 1- Do you have pain? Please evaluate your pain. (On a scale of 3: 0 = No pain, 1 = minimal, 2 = Moderate, 3 = Severe)
- 2- What are your eating habits? (Normal, Limited, Mixed)
- 3- Do you feel clicks, subluxation, locks or headaches?
- 4- Have you ever had mandibular luxation before or after the surgery?
- 5- What do you think about the scar? (non-visible, Normal, abnormal)?
- 6- Are you satisfied by this surgery? (satisfied, moderately satisfied, unsatisfied)

Postoperatively, timing of clinical improvement, early and late complication were documented. The majority of cases (77.14%) had minimal or no pain postoperatively. One hundred and one (96.2%) had improvement of their eating habits. No persistent subluxation, locks or headaches documented postoperatively. Two patients had recurrence after 3 years due to screw expulsion. They were operated using the same technique with good results.

Discussion

The temporomandibular joint (TMJ) is a unique joint of the body that acts primarily by its sliding function and consists of the articular fibrocartiliginous disc. The joint diarthrodial function

allows both rotational and transitional movement of the joint. Anatomically, the posterior border of the disc is secured by a highly vascular attachment with elastic fibers. Several neural and vascular structures near the joint that may become compromised, causing joint pathology.

The term TMD (Temporomandibular disorder) is usually used when both functional and/or joint pathology are present. These changes may lead to secondary changes in the structure of the joint resulting in further symptoms and signs. The earliest written description of TMJ pathology was by Costen in 1934 when he published his paper "A syndrome of Ear, and Sinus symptoms dependent on disturbed function of the Mandibular Joint".^[6] The term TMD has come to characterize a broad range of conditions with various symptoms, including pain in the face or jaw joint, headache, earache, dizziness, masticatory musculature hypertrophy, limited mouth opening, closed or open lock of the TMJ, abnormal occlusal wear and clicking, popping or grinding sounds (crepitus) in the jaw joint. More than 80% of patients can be adequately treated by conservation treatment. These treatments include reassurance, Diet modification, rest, splints, physical therapy, behavior modification, NSAID and Botox injections.^[6,7]

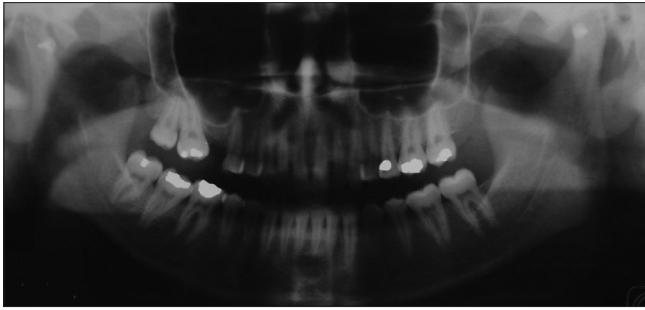


Figure 5: Panoramic view X-rays verifying the location of the screws

Laskin in 1969 has developed the term myofascial pain and dysfunction.^[8] By that he was able to distinguish patients with muscular related symptoms that are mainly treated non-surgically from those with joint or articular related symptoms mainly internal derangement (ID) who may benefit by surgical means. In a closed mouth position, the disc is in a normal superior position when the posterior band of the disc is in the 12 o'clock position on the top of the condyle. Internal derangement is either anterior or Medio-anterior displacement of the disc when there is centric occlusion as the teeth are closed into the intercapsular position. In the literature, few treatment modalities have been described with varying degree of outcome. Bhargava *et al.* conducted a review to compare ultrasound-guided arthrocentesis vs. conventional arthrocentesis in which they showed a decreasing VAS score in both groups for a period of 1 month after the procedure, however there was no statistical difference in the outcome between the groups.^[9]

Efeoglu *et al.* performed arthrocentesis with or without lavage in a series of patients in 2018.^[10] The authors in that study used subjective measures as means of their assessment, including: spontaneous pain, pain on function, difficulty on chewing, perceived disability of jaw movements, and they concluded a statistically significant reduction in the reported symptoms by the subjects of their sample for the aforementioned variables (p -value = 0.001). According to Currie *et al.* in their review published in 2011, open surgical intervention for the treatment of TMJ ID offers better outcome in terms of reducing pain after 12 months when compared to non-surgical or arthroscopic treatment.^[11] This is also consistent with a metaanalysis done by Al-Moraissi in 2015 that showed superior results in terms of pain reduction compared to arthroscopic treatment, however functional outcome showed no difference.^[12] This observation can be considered fundamental in considering the technique we are presenting here.

Although the role of surgical treatment was controversial^[13] with no clear criteria in the literature, most of the literature reviews have reported better outcomes with surgical treatment mainly in advanced ID. Perhaps the only detailed surgical indication in the literature was described by Wilkes in 1991 which included repetitive symptomatic episodes, evidence of clinical and radiological progression and positive radiological study of stage 2 through 5 of internal derangement.^[4] Dimitroulis concluded that careful case selection^[13,14] is the most essential ingredient for

successful outcome. Internal derangement is the most common cause of serious TMJ pain and dysfunction and that can be treated surgically.^[1] History and examination were a corner stay in the decision-making “to or not to” operate. Wilkes described the different five stages of internal derangement.^[4] According to American society of temporomandibular joint surgeons surgical consultation should be offered within 2-3 weeks to patients with documented internal derangement and in whom symptoms persists despite a trail of non-surgical modalities.^[2] These surgical modalities include nevertheless; arthrocentesis, arthroscopy, condylotomy and arthrotomy. Recently, Laser Therapy has been advocated to produce the anti-inflammatory and analgesic effect to treat TMJ arthralgia.^[15] More recently, Marzook *et al.*, compared the outcome of TMJ arthrocentesis vs. injection with hyaluronic acid and corticosteroids on 16 patients, he concluded that both treatments were effective to treat the disease with no statistical difference, however the follow-up period was limited to 3 months post-operatively.^[16] In a study published in 2020, a novel protocol for TMJ disease treatment utilizing a computer assisted arthrocentesis was used.^[17] In his study, Mahmoud *et al.* used a 3-D printed patient specific guides to pass the needles into the joint space. The aim was to assess the accuracy of this technique, which the author states that it was effective in locating the entry site. Compared to our technique, the advantage that we encompass in the surgical technique is offering an adequate exposure of the disc and a safer approach in maintaining the vascularity of the joint structures.

Historically different surgical techniques were described for disc repositioning. Through a preauricular approach, Annandale in 1887 was the 1st to surgically repair a torn meniscus.^[18] In 1978, by arthroscopic evaluation Wilkes described the anatomy, morphology and function of TMJ.^[19,20] As per his outcomes disc repositioning became accepted using different modalities. Further after, McCarty and Farrar were the first to describe a surgical technique for disc repositioning in 1979.^[3] Hall introduced disc suture plication in 1984 without involvement of the lower joint.^[21] In 2001, Coltrell introduced Mitek anchors for stabilizing the TMJ articular disc.^[22] Hereby we introduce a new modified simple surgical technique with effective results.

Conclusion

Use of UPS technique in treating patients with ID is an efficient and simple technique. This technique has the advantage of not compromising the vascular integrity of the articular surface. With a significant improvement in symptoms and signs post disc replacement and fixation, we have adopted this technique that has comparable results to other techniques regardless of the severity. The opportunity to expose the whole articular surface and maintain the vascular integrity is of important value.

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Declaration

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

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Conflicts of interest

There are no conflicts of interest.

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