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Clinical Assessment of Arthroscopic Temporomandibular Joint Discopexy Using Wire Fixation Technique

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ABSTRACT

Background: Anterior disc displacement is one of the most frequent temporomandibular joint (TMJ) disorders, which often results in clicking, joint pain, a limited range of motion and masticatory difficulties. ***Methodology:*** Four patients (with a total number of six joints) who had significant pain and dysfunction that did not respond to non-surgical therapy, went into arthroscopic disc repositioning using wire fixation for 3 weeks then it was removed, and the patient continued on occlusal splints. Results After six months postoperatively, there was a significant increase in the MIO (Maximum incisal opening) and an insignificant decrease in the pain perception in the VAS (visual analogue scale) ***Conclusion:*** The study concluded that arthroscopic temporomandibular joint disc repositioning is an effective minimally invasive procedure for the treatment of some temporomandibular joint internal derangements refractory to conventional conservative therapy in regards to clinical outcomes.

1. INTRODUCTION

Anterior disc displacement is an anatomical abnormality of the TMJ which detected radiographically through MRI and clinically through limitation of mouth opening and pain[1].Conservative non-surgical methods of treatment including medical management, Physical therapy and orthotic devices. They are used to relieve pain and reduce the degree of inflammation inside the joint thus improving the joint function. Failure or non-improvement of the conservative therapy that has been conducted for minimum of 3 months, thus a minimum invasive surgery should be done as arthrocentesis and arthroscopy[2,3]. Arthrocentesis composed of insertion of two needles through the superior joint space, one for fluid inflow and the other for the outflow to flush any joint adhesions; it is also called joint pumping. Now, it can be done by a single double needle cannula. Arthroscopic joint surgeries are levels which consisted from the simplest form of lysis and lavage of the joint space with intra-articular injections of medications as corticosteroids and hyaluronic acid. Another level is operative arthroscopy which is represented by Arthroscopic disc reposition and fixation. Arthroscopic disc repositioning is considered an alternative approach for the open surgery disc repositioning which is much invasive and has many complications as facial nerve injury and infection of the surgical site[4,5] .

2. METHODOLOGY

After approval of the Ethics Committee of Future University in Egypt, the study was conducted according to the Declaration of Helsinki (2013) on four patients (with a total number of six joints) who were selected from the outpatient clinic of Oral and Maxillofacial Surgery department in the faculty of dentistry, Future University in Egypt acc. All patients had significant pain and dysfunction that did not respond to non-surgical therapy.

Inclusion Criteria consisted of:

- Clinically reduced mouth opening and/or painful maximum mouth opening.
- Magnetic resonance imaging (MRI) demonstration of Wilkes stage III, early stage IV for internal derangement.
- Unsuccessful non-surgical treatment for at least three months prior to surgery.

Exclusion Criteria consisted of:

- Patients with evidence of major jaw trauma.
- Patients with systemic diseases such as uncontrolled diabetes, uncontrolled hypertension.
- Patients who had a previous open intracapsular TMJ surgery.

Before arthroscopic TMJ Disc repositioning and fixation procedure, the patients were carefully examined clinically, based on TMJ assessment standardized form

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Patient Consent:

- All the patients had a written consent and the facial nerve assessed preoperatively and directly post-operatively, also all the patient had panoramic x ray preoperatively to exclude any dental causes that may cause or mask the manifestations of TMJ internal derangement.
- Based on the clinical and imaging findings, a Wilkes staging was assigned to each joint pre-operatively. According to Wilkes stages for internal derangement, the cases were grouped.
- Surgical Procedures:
- Under General anesthesia using naso-tracheal intubation which make it possible to manipulate the mandible during the operation. Aseptic technique was a prime concern; the patient draped for both TMJ and to the puncture sites and the patient reexamined clinically for noises and restriction of jaw motions and the surgical set for arthroscopy and discopexy were prepared.

Palpation of the TMJ anatomy, following the prepping and draping of patient, the palpation of joint anatomy was done through palpating the lateral joint anatomy in preparation for the glenoid fossa puncture site while the assistant manipulated the jaw. With the condyle seated, the assistant`s thumb rolled into the buccal fold away from the occlusal surfaces to allow proper seating of the condyle in maximum occlusal intercuspation. The areas that were palpated are: the superficial temporal artery preauricularly, the condyle in back, forward and side to side motion of the mandible, the zygomatic process of the temporal bone, particularly the maximum concavity of the glenoid fossa (the soft tissue depression for the fossa portal puncture is located in this area), and the articular eminence with the c Marking the fossa portal puncture site, first puncture was placed at the maximum concavity of the glenoid fossa (Fig. 1).

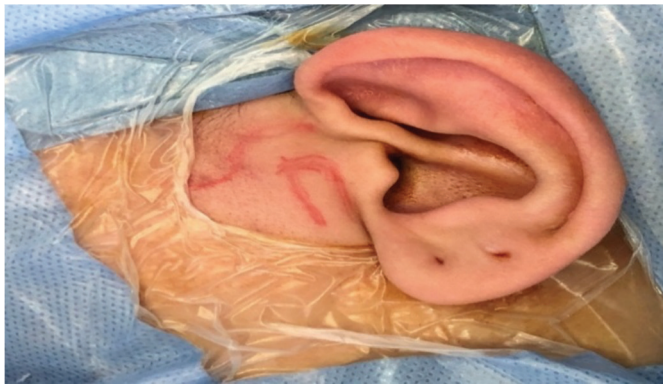

Figure (1) — Marking of TMJ Anatomy of Fossa Portal

Insufflation of the superior joint space: the purpose was for distension of the joint to expand the target area. 3 ml 0.5 % Marcaine®(Pfizer Inc, NY,USA) in a 3ml syringe with a 25 gauge needle was used in the procedures. The needle penetrated the skin in the preauricular crease, approximately 10 mm inferior to the Holmlund –Helsing line, at the junction of the tragus and the pinna. The needle was aimed at the central portion of the back slope of the eminence. Bone was contacted with the tip of the needle. The average joint took approximately 3 ml, a plunger rebound greater than 1 ml indicated sufficient insufflation (Fig. 2).

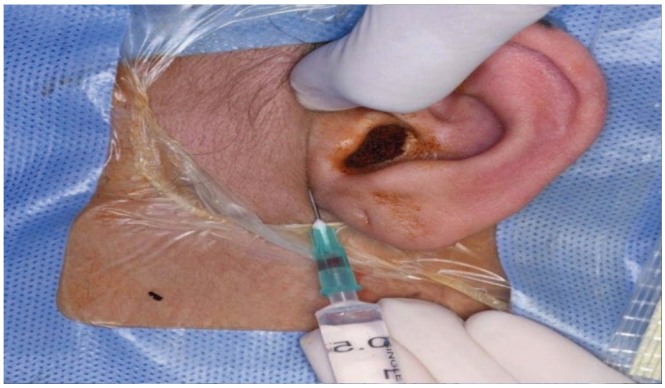

Figure (2) — Insufflation of the superior joint space

Fossa Puncture: the puncture was placed at the maximum concavity of the glenoid fossa, a 2 mm inner diameter, 2.2 mm outer diameter operative cannula was held in the right hand for a right joint puncture or in the left hand for a left joint puncture. With the condyle forward, the sharp trocar penetrated the skin with a rotational motion. The trocar was then advanced until contact was felt with the osseous structure superior (lateral lip of glenoid fossa). The trocar was used almost in the same fashion as a periosteal elevator after it perforates the temporalis and the periosteum at the level of the zygomatic bone. The zygomatic arch was felt between the policies of the non-dominant hand and the index of the dominant hand. The trocar then stepped off the ledge. The distance from the skin surface to the ledge varied between5-10 mm. the trocar was then rotated until a slight pop is felt , it was inserted approximately 10-15 mm. then trocar was directed in a horizontal plane and advanced to penetrate the capsule and be advanced in the superior joint space (Fig. 3 A&B) .

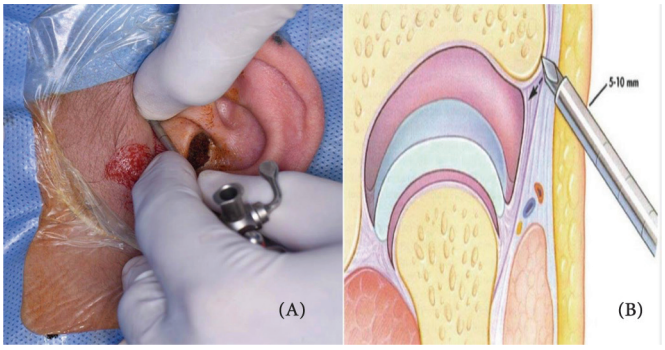

Figure (3) —A- Cannula at the fossa puncture site. B- Diagram of cannula and trocar advanced to the inferolateral aspect of the zygoma then inferiorly stepped off the osseous edge (MaCain, 1996)

The cannula was not inserted more than 20-25 mm from the skin to the center of the joint. Before inserting the scope, the joint was backwashed with lactated Ringer (LR) in order to remove all blood and synovial fluids through the irrigation system until the return fluid is clear.

Using a 1.9 mm, 30˚(KARL STORZ®)scope (Karl Storz Medical Inc, Tagerwilen, Switzerland) is inserted in a 2 mm inner diameter, 2.2 mm outer diameter operative cannula. The white balance is adjusted pre-entry. The image on the monitor confirmed correct entry into the superior joint space. With the mandible protruded, the scope was directed to the center of the fossa area of the joint (Fig. 4). The assistant insufflated the joint with 2-3 ml of fluid in order to maintain good joint distension.

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A 22 gauge needle was inserted approximately 5 mm anterior and inferior to the glenoid fossa puncture site to establish outflow. The system then switched from manual to continuous irrigation from LR hanging bag (Fig.5)

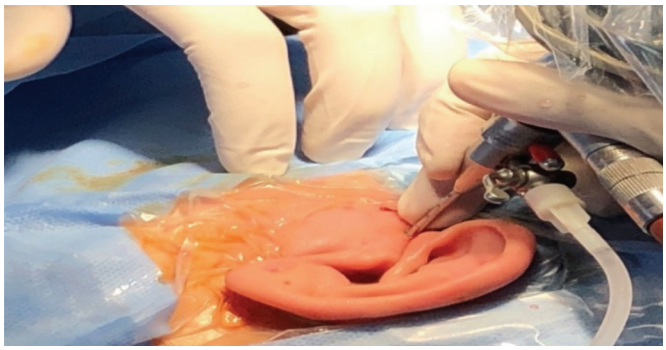

Figure (4) — The scope into the fossa portal inserted for 25mm safety depth

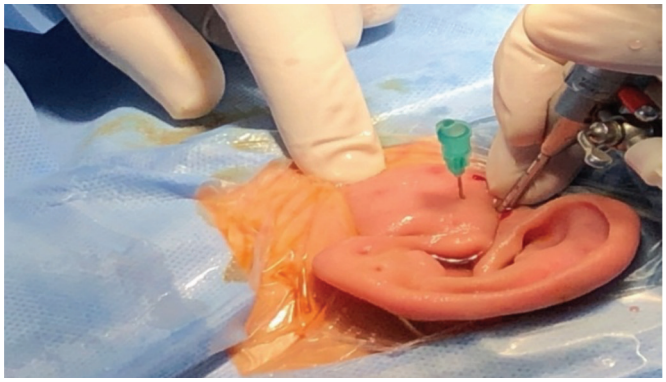

Figure (5) — Establishing an outflow

Diagnostic sweep: the seven points of interest of the TMJ arthroscopic examination were examined as follows:

- Area 1.Medial synovial drape: the drape was reached by swiveling and pistonning the arthroscope until the drape became visible.
- Area 2.Pterygoid shadow: this second area was reached by swiveling the scope anteriorly and pistonning medially until the shadow came into view.
- Area 3.Retrodiscal synovium: this third area to be examined was reached by back-tracking the initial path of the scope. Once the medial synovial drape was visible, the scope was pistonned out (lateral) and swiveled minimally to bring into view both anterior and posterior components of the retrodiscal synovium.
- Area 4. Posterior slope of the articular eminence: from the lateral recess the scope was pistonned-out until the periphery of the capsule is visible. From there the scope was advanced so that the capsular fragmentation was no longer visible. To examine the fibrocartilage of the back slope of the eminence, the scope then slowly pistonned out, back tracking the last travel path. To complete the examination of this area, the scope was swiveled superior and posterior. From that position, pistonning –out to the joint periphery permitted visualization of the glenoid fossa.
- Area 5 Articular disc: with the scope at the extreme periphery of the joint, from this postero-lateral position, the posterior band of disc was located. With the condyle forward, the inspection proceeded in an anterior and inferior direction from this peripheral position to locate the actual disc position an.

Before examining the rest of the diagnostic anatomical areas 6 and 7, the following was assessed:

Joint dynamics and disc mobility: the scope needed to be at the most peripheral postero-lateral position, almost exiting the joint space. At this stage, the assistant manipulated the condyle in a seated position in a reciprocal fashion, together with the surgeon.

Arthroscopic assessment of disc position: arthroscopic observation was performed first with the condyle forward. Then in the seated position, the retrodiscal synovium came into view. And the roofing of the disc with the condyle forward was observed.

Roofing: at this stage, an attempt was made to specially grade the amount of displacement by arthroscopic observation of the disc to be repositioned and fixed posteriorly.

- Area. 6. Intermediate zone: with the condyle forward, the scope was pistonned to facilitate the placement at approximately 1 mm away from the interface between the juncture of the articular eminence and the articular disc.
- Area .7. Anterior recess: the condyle was seated and the anterior triangle identified. The arthroscope was pistonned directly into the anterior recess until mid-portion of the anterior synovium was visible.

After finishing the diagnostic sweep with the documentation of anatomical sites and dynamics of the joint, the irrigation was stopped and lavage needle was removed carefully.

The outflow needle was removed, and using a millimeter ruler or marked cannula, the second puncture site was located using triangulation principles (to be far away from the arthroscope portal, the same distance as the depth of the first cannula in the same vector) guided by the arthroscope illumination (Fig.6 A&B). The second puncture placed exactly in the most lateral part of the disc synovial crease represents the site of the entry of the working cannula in triangulation procedures. The ideal position of the working cannula was directly parallel to the disc–synovial crease in the anterior recess to facilitate the operative procedures. The ledge of bone felt at this point, is the anterior slope of the articular eminence. Entering perpendicular on the skin by the sharp trocar then the second cannula passed into the joint under direct arthroscopic visualization, removal of the trocar and insertion of the straight probe was done to detect the disc synovial crease.

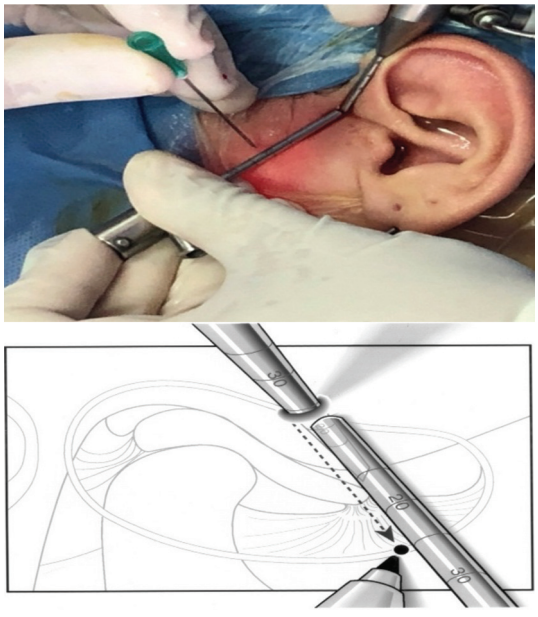

Figure (6) — A- Triangulation technique to locate the second cannula portal site. B- Diagram of double puncture technique (McCain ,1996)

Anterior Release /lateral pterygoid myotomy:

The procedure of anterior release was done for the purpose of disc mobilization under arthroscopic direct vision. It was important to maintain the condyle in closed position while working in the anterior recess. A straight probe was inserted through the operative cannula to confirm the disc synovial crease. The intra-articular incision was done using Arthrocare® (Arthrocare Corp, Coblator unit, Austin, TX,USA)(cold ablation cauterization device) to decrease any heat inside the joint at the juncture between the pterygoid shadow and the anterior recessed synovium in the disc–synovial crease through the synovial membrane (Fig. 7). The myotomy was done from the extreme medial component laterally; all muscle components were resected.

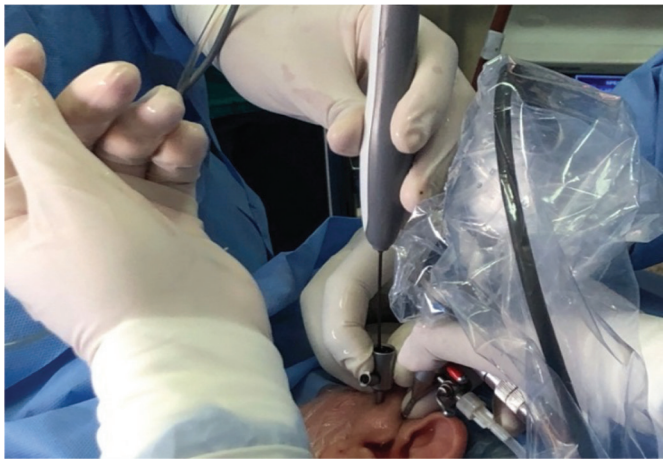

Figure (7) — Applying the arthrocare into the operative cannula for the anterior release

Disc reduction

The operative cannula and the arthroscope were then "walked back" in lateral sulcus to posterior pouch. Once these 2 instruments had reached the peak of articular eminence, the condyle was pulled forward; then both instruments could drop into the posterior pouch. The disc was reduced by compressing the Retrodiscal tissue laterally and inferiorly with the straight probe, with the condyle in a forward position. The disc reduction could be felt by hearing a pop and could be seen arthroscopically (Fig. 5) .

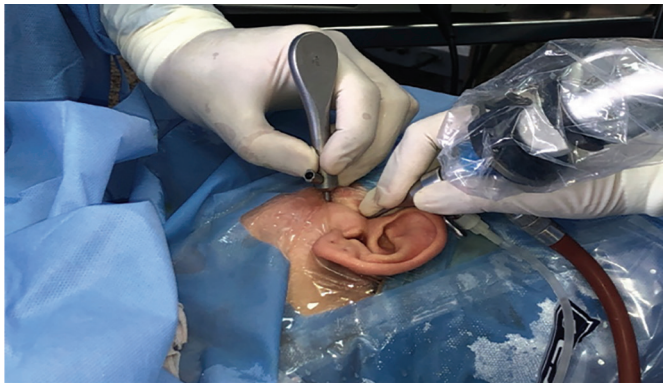

Figure (8) — External view of disc reduction using the straight probe

Disc fixation

The target area of fixation was the *posterior lateral corner of the disc–condyle* assembly, *the area of the lateral pole where the disc attaches to the condyle*. With the disc held in reduction by the straight probe, the vector measuring system was again used to target the area for passing the straight Meniscus Mender II (Smith & Nephew®) through the skin and subcuticular tissues, the needle tip touching the condylar head, into the inferior joint space, and then angled superiorly to target the superior lateral aspect of the posterior band of the disc till it was visible on the monitor (Fig 9 A-C).

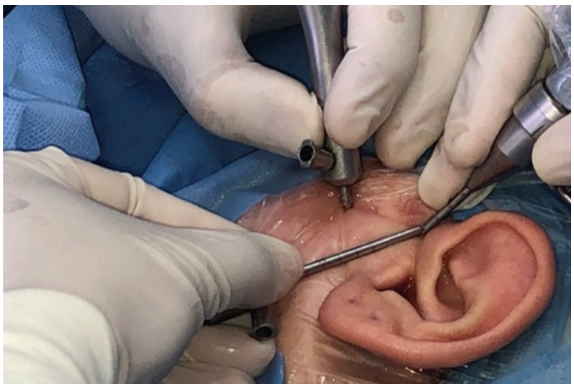

Figure (9A) — Triangulation measurement to insert the Meniscus Mender to pass the wire

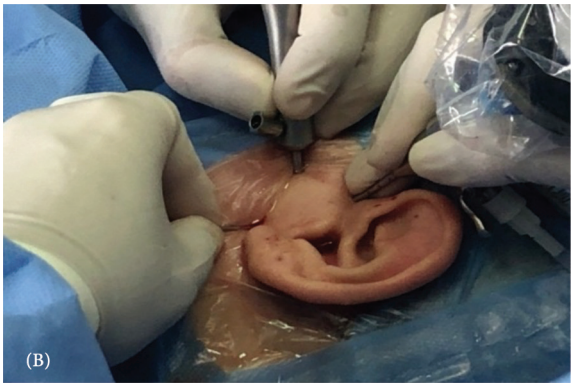

Figure (9B) — Clinical view after inserting the meniscus mender

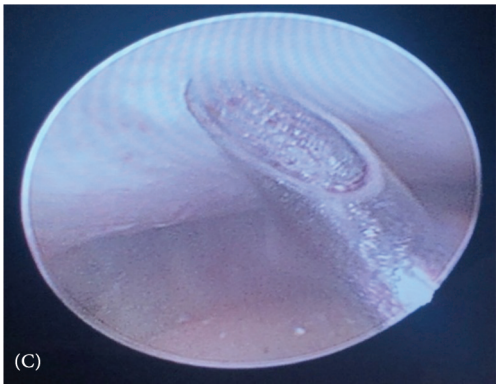

Figure (9C) — Arthroscopic view of the cannula tip after passing from the inferior to the superior joint space engaging the reduced articular disc

The lasso suture retrieval instrument was then applied at the level of the earlobe just slight inferior and anterior to the scope portal site, inserted in the preauricular skin crease into the superior joint space through the Meniscus Mender cannula and the needle tip was passed into the superior joint space till it was visible into the monitor (Fig.10).

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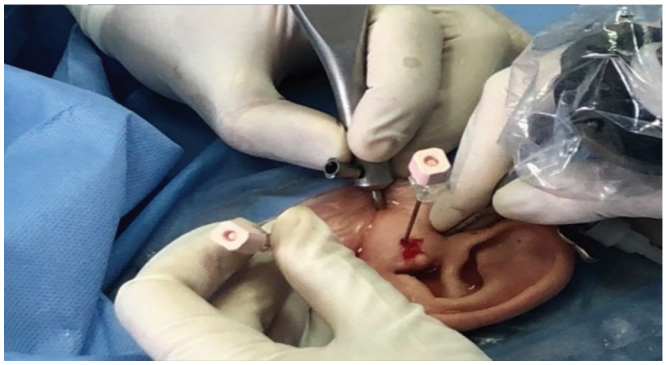

Figure (10) — External view of the meniscus mender in place

Then feeding a stainless steel ligature wire through the meniscus mender cannula into till the wire was visible into the monitor , through the second puncture into the superior joint space, the obturator is replaced by the lasso loop to catch the wire inside the loop . After catching the wire, the lasso was pulled containing the wire till exiting the skin, and then the first cannula of the mender is removed leaving the wire passing into the skin (Fig. 11).

Gripping the two wire ends by hemostats to avoid escaping the wire back into the tissues, then passing them into two needles gauge 22, into a gauze patch over the skin and a metal button to stabilize the wire ends.

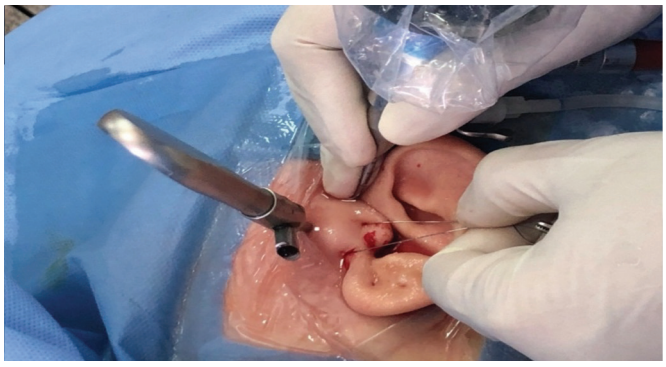

Figure (11) — The two wire ends external view engaging the disc

The metal button had the two wire ends projecting inside its holes and then doing a twisting motion plicating the disc after removal of the straight probe which was passed inside the knot, firm pressure over the knot and cutting the excess wire and bend the knot. Removal of the straight probe and the cannula then manipulation of the jaw under anesthesia was done to confirm of proper disc position with firm fixation (Fig. 12 A& B).

Intra-articular injection of Curavisc® (Fig. 13) (Curavisc 20mg,2 ML syringe, Pharma Con, Germany), hyaluronic acid into the joint space through lavage track of the fossa portal cannula after removal of the fluid line .then the scope system was removed from the joint , transient pressure over the skin puncture was done followed by skin sutures of the two portals with prolene®(Prolene,Ethicon Inc, Cornelia, Georgia, USA)suture 5-0 and had an antibiotic ointment Terramycin® (Pfizer Inc, NY, USA) over the knots to avoid any skin infection .then manipulation under anesthesia to record the mouth opening then Covering the button and the knot sites by surgical dressing and finally the patient got extubated with reversal of anesthesia gently(Fig. 14).

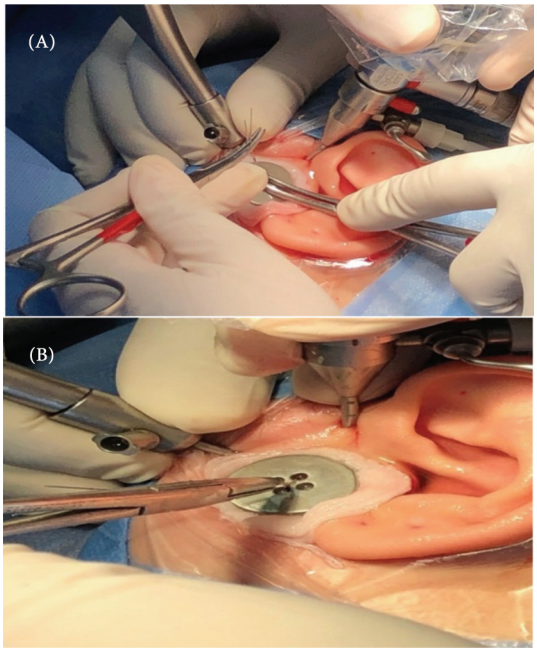

Figure (12 A,B) — Button fixation with the wire loop

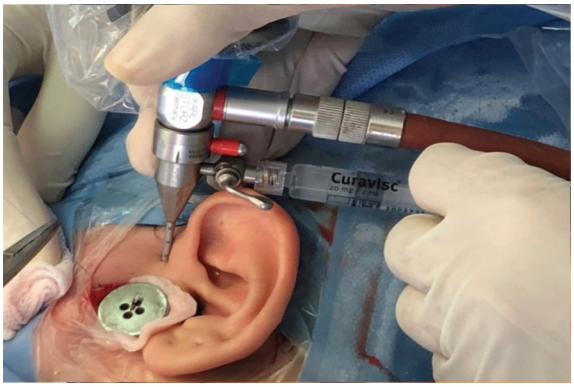

Figure (13) — Intra-articular injection of Curavisc

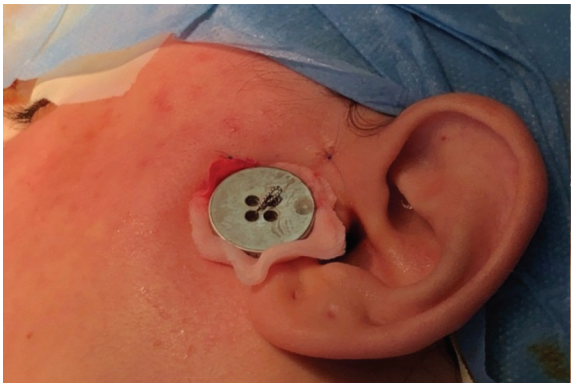

Figure (14) — Button in position and the portals were sutured

Post-operative patient management:

Antibiotics: every patient was bridged from I.V to Unictam® 1.5 gm (Unictam 1.5gm Vial, Medical Union Pharmaceuticals (MUP), Egypt) or Augmentin®1gm tab (Augmentin 1 gm tab, MUP, Egypt)for five days, in case of penicillin allergy, clindamycin® 300mg capsules (Dalacin C 300mg cap, Pfizer, NY, USA)was used instead.it was taken two times per day.

Analgesics: We advocated the administration of Ketolac®30 mg IM (Ketolac 30mg amp, Amriya Pharma Ind, Alex, Egypt)for the first three days then followed by 10 mg tablets when needed.

Anti-inflammatory: patients received tapered doses of steroids for the next 24 hours post-operative, Mobic® 7.5 mg tab(Mobic 7.5mg tab , BoehringerIng, Germany) was used for all patients.

Antiemetic: to prevent exaggerated opening of the mouth in case of gag reflex, Zofran® 4 mg tablets (Zofran, GlaxosmithKline Pharma, ARE)were taken first 48 hours.

Steroids: Single dose of dexamethasone ® 8mg(Dexamethasone 8 mg IM, Sigma-Tec Pharma.)taken intraoperative then Depomedrol® 40 mg IM (Depomedrol 40mg IM: Egyptian Int. Pharma , Egypt)before patient discharge.

Diet: full liquid diet for the immediate post-operative period of hospital stay, followed by soft diet for three months, reaching regular compromised diet.

Panoramic x ray before wire removal

Skin sutures, button and wire were removed three weeks after the surgery during the post-operative follow up visits.

Follow up plan:

All patients were clinically assessed at 1, 2 days post-operative then at 1, 3,6,12 week using the follow up forms followed by doing MRI 6 months post operatively to compare the disc position. All patients did panoramic x-ray before wire removal to make sure of the wire continuity holding the disc (Fig. 15); wire removed using a wire cutter and gentle pressure over the button.

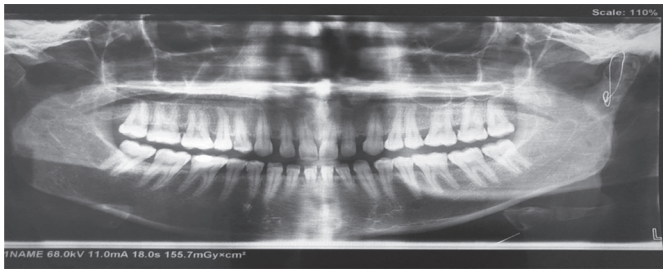

Figure (15) — Post-operative panoramic x-ray

Post-operative rehabilitation:

Full coverage occlusal stabilization splint is resumend to be used post-operatively patient did exercises as hinged opening of just two fingers for the first period of time and lateral excursion exercises with a finger on the incisor teeth and moving jaw tooth to tooth(Stage II) physical therapy. Protrusion involved only lining up with the anterior dentition. Avoid sleeping over the button side .

$$\text{Percent Increase} = \frac{\text{Final Value - Initial Value}}{\text{Initial Value}} \text{ X } 100\ \%$$

3. RESULTS

In this study, data after arthroscopic disc repositioning were collected and analyzed as means ± standard deviations and percentages for after six months follow up period in addition to percentage of change calculation according to the following formula

Statistical analysis was carried out using Microsoft Excel 2010 program. While testing significance was performed using using IBM® SPSS® Statistics Version 20(SPSS, Inc., IBM Corporation, NY, USA) for Windows and Graph Pad Prism Version 8(Graph Pad Prism Company, USA).

Paired t test and Wilcoxon signed-rank test for parametric and non-parametric data respectively were performed to test the significance between the follow-up periods.

Finally, Chi Square test was performed to test the significance for quantitative data (percentages) pre and post-operative.

The results of this study are represented in the following figures. A probability level of P≤0.05 was considered statistically significant

1. Pain Change after Arthroscopic Disc Repositioning using (VAS):

Regarding pain change after disc repositioning, preoperative (VAS) representation revealed (67.5±32.445) while postoperative (VAS) representation revealed (21.25±20.06), as listed in table (1) and showed in figure (16).

After six months, there was an insignificant decrease in pain perception by (68.52%) using Wilcoxon signed-rank test for significance evaluation as P-value>0.05, listed in table (1).

Table (1):

Pain Change after Arthroscopic Disc Repositioning using (VAS):

	Pre-operative	Six Months Post-operative	% change	P-value
(VAS) M±SD	67.5±32.445	21.25±20.06	-68.52%	0.052 (ns)

VAS; Visual analogue Scale
M: Mean, SD: Standard Deviation, %; Percentage, P: Probability level
Ns; Insignificant difference

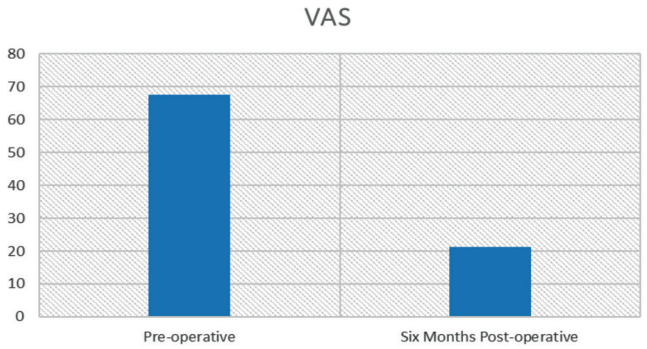

Figure (16) —Bar Chart revealing Pain Perception Change after Arthroscopic Disc Repositioning (VAS)

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2. Maximum Incisal Opening Change after Arthroscopic Disc Repositioning using (MIO):

Regarding maximum incisal opening change, preoperative (MIO) representation revealed (28.75±6.29) while postoperative (MIO) representation revealed (41.25±3.4), as listed in table (2) and showed in figure (17) and clinical photos in fig (18).

After six months, there was a significant increase in MIO by (43.48%) using Paired-t test for significance evaluation as P-value<0.05, listed in table (2).

Table (2):

Maximum Incisal Opening Change after Arthroscopic Disc Repositioning (MIO):

	Pre-operative	Six Months Post-operative	% change	P-value
(MIO) M±SD	28.75±6.29	41.25±3.4	43.48%	0.007*

MIO; Maximum Incisal Opening
M: Mean, SD: Standard Deviation, %; Percentage, P: Probability level
**significant difference*

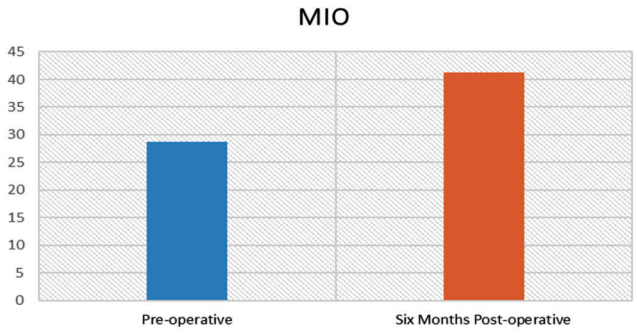

Figure (17) — Bar Chart revealingMaximum Incisal Opening Change after Arthroscopic Disc Repositioning (MIO)

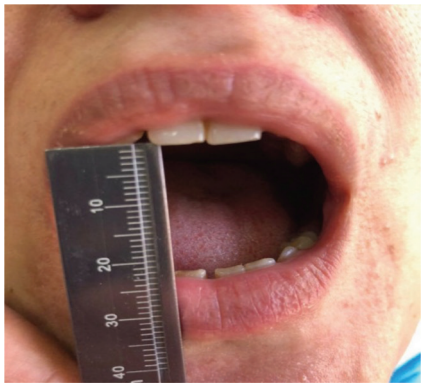

Figure (18A) — Preoperative mouth opening of 20mm

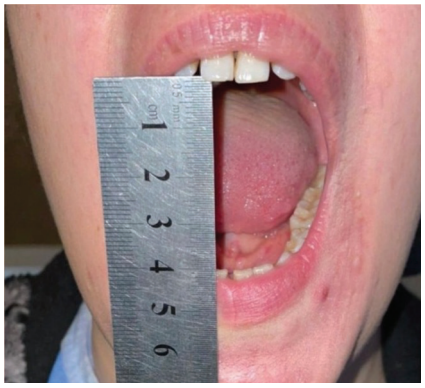

Figure (18 B) — 6 months Postoperative mouth opening of 42mm

4. DISCUSSION

Despite of the diversity in the management beliefs of TMJ diseases, almost all TMJ specialists agreed upon the initial management with the most conservative approaches. This directed more interest towards the minimally invasive TMJ surgical management. One of those modalities is the TMJ arthroscopy with its different levels.

This study was designed to test the efficacy of arthroscopic TMJ disc repositioning in the management of TMJ internal derangement , we hypothesized that performing such a procedure would add to the successful outcome, obviating the need for an open joint technique , especially in patients with Wilkes stage III, early stage IV.

In the current study, patients with evidence of major jaw trauma , systematic joint or muscle diseases , and/or with major jaw deformities , were excluded from the study , in order to ascertain the homogeneity of the study sample that coordinate with the indications for TMJ disc repositioning and fixation procedures, so all the patients would benefit from the procedures.

According to the current TMJ established literature, the most commonly used classification to describe the severity of internal derangement based on the mechanical theory was proposed by Wilkes [6] in 1989 .This is why the current study used it as a reference for clinical and MRI diagnosis of TMJ patients classification and grouping for disc displacement stages.

The protocol and philosophy behind selecting the surgical patients in the current study were to be confined to the ones who had failed the conservative non-surgical management including medical & orthotic rehabilitation. According to Randolph[7], who established his theory in 1990, that around 90% of all TMD can be successfully treated by conservative non-surgical methods as occlusal orthotics and physical therapy[7].All the selected patients were experiencing pain and TMJ dysfunction .

The technique of TMJ disc repositioning and fixation proposed in this study, has some modifications from the other techniques used previously. McCarty and Farrar[8] followed by Dolwick and Nitzan [9]were the first to describe an open surgery technique for joint disc repositioning as a treatment of TMJ ID with the primary goal of restoring normal, functional anatomy. They reported a 94% success rate, Abramowicz and Dolwick [10] have recently reported successful results after more than 20 years of follow-up. The outcomes they reported were for all phases of ID.

The initial step of the examination under anesthesia was done prior to the puncture technique. It provided the surgeon with valuable data both pre and post-operatively. The pre-operative examination ascertains joint mobility, articular bruits and most important, the degree of difficulty of the upcoming

punctures. Once the anesthesiologist administers the muscle relaxant, all muscular elements related to condylar motion or disc function are eliminated.

During the step of joint insufflation: adequate joint distension was indicated by the amount of pressure on the plunger. Stenosed or fibrotic joints typically took less fluid and the pressure required to insufflate the joint was increased (early rebound). Hypermobile joints or joints with disc perforation without adhesions required more fluid.

A vasoconstrictor was not used in the present study as it could mask a correct diagnostic sweep for the joint. In marking the fossa portal site, the measuring technique has been established long time ago by the Holmlund and Hellsing anatomical line[11,12] . In the current study, this line was not used. The fossa portal puncture instead was marked immediately caudal to the maximum concavity of the glenoid fossa, which is palpated digitally to avoid any anatomical variation and ascertain the accuracy of the fossa puncture site in the joint.

Sticking to the proposed order during the diagnostic sweep is a very crucial point. As losing orientation inside the joint, even for a short time can be very frustrating experience for the arthroscopist. Adding to the obstacles of inexperience, intra-articular pathology can deepen the confusion. The easiest method for preventing this occurrence is for the operator to be comfortable with the four classic intra-articular anatomic landmarks: medical synovial drape, oblique protuberance of the retrodiscal synovium, posterior slope of the articular eminence, and the juncture of the anterior synovium and anterior band of the disc. The diagnostic sweep should be minimized to one trial or maximum two trials if necessary to avoid adhesive healing phenomena that might result from scuffing of the joint surface areas. Another benefit from sticking to the single sweep is to minimize the postoperative sequelae as edema, hematoma and bleeding.

The rule of triangulation for the second puncture was used according to McCain[13] guidelines followed by complete myotomy of the superior belly of the lateral pterygoid muscle. Then disc reduction and fixation into the new position done with the aid of Meniscus Mender suturing devices using a stainless steel wire . Compared to McCain[13] who used initially O-polydioxanone suture (PDS) to fix the disc and had the knot underneath the skin, the suture was removed 3 weeks postoperatively .

At the end of the arthroscopic procedures, gentle manipulation under anesthesia did not only provide the initial step in the patient`s post-operative rehabilitation/physical therapy, but also represented a prediction factor for the post-operative course of the case. The noticed transitional malocclusion immediately post-operative usually with posterior open bite in occlusion is a period of intra-articular settling of the new disc position that has to occur in an undisturbed environment. This critical post-operative transition to normal occlusion cannot be encroached upon by an accelerated return to functional or Para functional. Thus patients were instructed not to force their teeth to contact or exert unnecessary stresses on their occlusion till return to normal occlusion, which was usually regained within 10 days after the surgery after muscle & ligaments reprogramming. No significant complications happened during or post-operative except one of the unilateral cases had temporary facial nerve affection that was persisted for a month and relieved with physiotherapy and muscle exercises.

Open surgery technique for joint disc repositioning as a treatment for TMJ ID. The primary goal was to restore normal, functional anatomy. It was reported of 94% success rate[14]. TMJ arthroscopic discopexy technique was first introduced by Israel and Tarro[13] in 1989 followed by McCain in 1992, the efficacy of the technique was evaluated by many authors yet the impact of ID severity on the success rates of arthroscopic discopexy is not well evaluated. Moreover, the literature is still lacking enough successful reports on disc stability after repositioning and fixation.

Tarro in 1989[13] described a blind suture and fixation to the external acoustic meatus. Israel in 1989 described the passing of a needle infero-superiorly from the lower space while McCain[13] developed a similar technique later, our technique, based on these techniques, has several advantages as the surgeon can see directly what he is doing during the procedures, no damage was made to the condylar head avoiding scar and late degenerative changes, and the disc is not fixed to the condylar head but it was fixed to the capsular tissues opposite to the myotomy site[15].

Reviewing the literature, success rates of arthroscopic TMJ discopexy for the treatment of ID have ranged from 80-86% [16]. In those earlier studies the success rates based on two main criteria which are: improvement in the mandibular movement in terms of MIO and reduction of pain levels. Mandibular movement was considered to be satisfactory when inter-incisal opening was 35-38 mm after the surgery.

In their study on 764 joints treated with arthroscopic suturing, reported 95.42% MRI-detected improvement in the disc position. However, the study disregarded symptoms and ID severity (Wilkes classification). Zhang et al[17] did not recommend arthroscopic disc repositioning for patients with TMJ ID of Wilkes stages IV or V. Gonzalez et al described excellent postoperative results upon disc repositioning in 16 patients using the double suture technique[18].

Recently in 2018, Yang and Martín-Granizo[19] supported their successful arthroscopic discopexy techniques with postoperative MRI evidence on medium and long follow up periods. It was concluded that the validation of the disc repositioning procedure requires more evidence based research and more standardization of the technique itself to concise the range of outcomes.

In this study, regarding pain change after disc repositioning, after six months, there was an insignificant decrease in pain perception by (68.52%). While, regarding maximum incisal opening change after arthroscopic disc repositioning, after six months, there was a significant increase in MIO by (43.48%) using Paired-t test for significance evaluation.

Yang and Martin [19]developed a study for discopexy in rotational disc displacement and its effectiveness evaluated over 24 months of follow-up. A total of 532 patients (749 joints) with rotational anterior disc displacement, the success rate was based on clinical parameters (VAS) for pain, (MIO) and radiographic data.

The clinical and radiographic data were collected preoperatively and at 1, 6, 12, and 24 months postoperative. The VAS score decreased following surgery ($P< 0.001$). A significant improvement in MIO was also detected ($P< 0.001$). Magnetic resonance imaging showed discs repositioned in both sagittal and coronal images. This study reports an effective and predictable technique of arthroscopic discopexy for rotational anterior disc displacement[19].

McCain et al[9] in 2015 did a study in 32 patients with a success rate up to 86% with significant improvement in MIO (P-001) and pain perception improved by decreasing the need for pain medications post-operatively.

The limitations of this study are due to the limited number of patients and the short term of MRI follow up. This current study was an attempt to assess the outcomes of arthroscopic disc repositioning which showed significant difference between pre and post-operative MIO and the change in the disc positioning on the MRI. On the other hand, there was insignificant difference in pain with VAS and joint loading.

5. CONCLUSIONS

The study concluded that arthroscopic temporomandibular joint disc repositioning is an effective minimally invasive procedure for the treatment of some temporomandibular joint internal derangements refractory to conventional conservative therapy in regards to clinical outcomes.

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6. RECOMMENDATIONS

Further research studies are recommended to tackle the same points of the current study with more emphasis on the following points:

- Larger samples sizes
- More focus on how to test the diagnostic accuracy of MRI in diagnosis of TMJ internal derangement
- Longer periods of follow up

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