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EFFECTIVENESS OF PARTIAL EMINECTOMY WITH MENISCORHAPHY IN SURGICAL TREATMENT OF MENISCAL DISPLACEMENT OF TEMPOROMANDIBULAR JOINT. ONE-YEAR PROSPECTIVE STUDY

Hosam E. Said*

ABSTRACT

Aim: The purpose of this prospective study was to evaluate the effectiveness of partial eminectomy with meniscorhaphy in surgical treatment of meniscal displacement of temporomandibular joint.

Patients and methods: A sample of 6 patients (5 females and 1 male) with unilateral anterior meniscal displacement who did not respond to previous conservative treatment were included in this prospective study. For all patients, partial eminectomy (removal of the posterior slop of the articular eminence), disc repositioning and meniscorhaphy (disc plication) to the lateral aspect of the capsule was performed. Clinical evaluation of mandibular movement, tenderness and joint sounds and patient subjective evaluation of pain and chewing ability were evaluated before surgery, 6 months and one year after surgery. Magnetic resonance imaging (MRI) was evaluated one year after surgery.

Results: Maximum interincisal opening and protrusive movements significantly increased from preoperative measurements to six months postoperatively, then significantly increased after 12 months compared to six months. Frequencies of deviation of midline during mouth opening, TMJ tenderness, joint sounds significantly increased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. Frequencies of pain intensity, and pain effect on life significantly decreased, and chewing ability significantly increased from preoperative measurements to six and 12 months postoperatively. However, there was no significant difference in these parameters between 6 and 12 months was observed. Frequency and percentage of normal disc position and morphology significantly increased after 12 months post-operatively compared to preoperative measurements.

Conclusion: Within the limits of this short-term prospective study, partial eminectomy with meniscorhaphy is considered an effective surgical treatment of meniscal displacement as it improves clinical outcomes, MRI findings and patient-based outcomes after 12 months of surgery.

* Lecturer Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Delta University For Science and Technology

INTRODUCTION

The meniscal displacement (internal derangement of the temporomandibular joint, TMJ) forms 41% of temporomandibular disorders (TMD)[1]. The meniscal displacement defined as any disturbance in the relation between the articular components of the TMJ (especially the condyle and the disc) that preclude smooth unrestricted joint movement[2]. The meniscal displacement usually associated with anterior or anteromedial displacement of the meniscus and the condyle of the mandible is pushed upward and backward when the teeth are in occlusion[3]. The forms of meniscal displacements are; meniscus displacement with reduction, meniscus displacement without production, and meniscus displacement with perforations[4, 5]. The classic symptoms for meniscus displacement are pain, joint sound, and the limitations of mandibular movement[2].

Conservative treatment could improve the symptoms in 86% of cases suffering from internal derangement with reducible disc, and only 7% of cases with irreducible disc[6, 7]. Surgical correction of meniscal displacement is needed in 2-5% of patients suffering from TMJ internal derangement who do not respond to conservative treatment[8]. The purpose of surgical correction is to remove pain and symptoms and improve mandibular movements[2]. The surgical correction is based on provision of more space inside the disc for articular components to function properly (intracapsular decompression)[2]. Several surgical techniques have been reported for intracapsular decompression such as arthrotomy, high condylar shave (condyloplasty), condylectomy, meniscectomy, eminectomy, and meniscoraphy (disc repositioning and plication)[9]. The condyloplasty and eminectomy are used to increase the joint space without affecting the position of the meniscus, while meniscoraphy aims to return the disc to its normal position within the joint space.[3]

No consensus exists in the literature about the most effective surgical approach and management of meniscal displacements[10]. In a previous systematic review and meta-analysis[11], the authors showed no significant difference between different surgical approaches used to treat TMD. The most common cause of disc repositioning failure is lack of adequate stabilization of the meniscus over long time[12]

Eminectomy is a reduction of the articular eminence to allow more space, create larger anterior recess in the superior joint space[3, 13, 14]. This allows unrestricted movement of the disc without entrapment the posterior attachment, thus providing more stabilization of the meniscus without damaging the unique structure of the condylar head [3, 15]. Moreover, eminectomy removes the physical barrier to articular disc activity without trapping of the bilaminar zone[3]. It was reported that meniscus repositioning with eminectomy may be effective treatment as it provides increase the intra-articular space, and joint decompression[10, 16]. Eminectomy and disc plications are also effective methods to treat recurrent mandibular dislocation[13, 17-21]. Pedraza-Alarco et al. [10] reported that meniscus repositioning with total Eminectomy provide short-term improvement in TMJ mobility and mouth opening. One of the limitations of total eminectomy is the pneumatized articular eminence in the temporal bone which may cause fractures of the temporal bone[22]

Although total eminectomy is effective treatment, it has several drawbacks such as fibrous adhesions that may occur between the disc and the bloody surface of the reduced articular eminence and recurrence[23]. Moreover, inadequate disclusion of the buccal segments in protrusive and lateral mandibular excursions may ocur[10]. Furthermore, the articular eminence was reported to be more prominent with internal derangement of the TMJ[24]. Consequently, partial eminectomy (reduction of the posterior slope of the articular eminence only) may be more convenient and conservative approach in providing TMJ decompression avoid complications of total eminectomy.

Another simple and effective technique that avoids the difficulty of meniscoplasty in disc repositioning is meniscoraphy. The technique consists direct suturing (plication) of the fibrous disk to the lateral wall of the articular capsule[16]. Meniscoraphy temporarily reduces the meniscus to its normal position over the head of the mandibular condyle. However, disc plication (suturing) will not support the meniscus in correct position without gaining more joint space (by condyloplasty or eminectomy), and relapse of meniscoraphy is more likely to occur[16, 25].

Accordingly, the aim of this prospective study was to evaluate the effectiveness of partial eminectomy combined with meniscorhaphy in surgical treatment of meniscal displacement of temporomandibular joint.

MATERIALS AND METHODS

Patient enrollment

A sample of 6 patients (5 females and 1 male, age ranged from 23 to 49 years) were selected for this prospective study from the outpatient clinic of Oral and Maxillofacial Surgery Department, Faculty of Oral and Dental Medicine Delta university The inclusion criteria were: 1) unilateral anterior meniscal displacement (internal derangement) of the TMJ with (n=1) or without (n=5) reducibility. The diagnosis of meniscal displacement was made by using magnetic resonance imaging (MRI), and clinical examination, 2) all participants had one or more classical signs and/or symptoms of meniscal displacement such as pain, tenderness, joint sounds, limitation of mandibular movement, and chewing disability persisted over at least 3 months prior to diagnosis, 3) Failure of previous conservative treatment to adequately control the symptoms and all participants were considered candidates for surgical treatment. Patients with the following conditions are excluded 1) Other forms of TMJ disorders, 2) patients who underwent previous surgical management of the TMJ, 3) congenital diseases or tumors in the TMJ, 4) systemic disease that affect joints such as rheumatoid arthritis, and 5) edentulous patients. The objectives of the study were explained to all participants, then informed consents were obtained from all patients. The study was conducted according to ethical principles stated in the Helsinki Declaration and the protocol of the study was approved by the ethical committee of the faculty.

TMJ examination and diagnosis of meniscal displacement

Medical history (systemic diseases), chief complaint, and dental history (trauma or harmful habits such as bruxism or clenching) were obtained from all participants. Furthermore, comprehensive TMJ clinical examination was performed to evaluate the following parameters: the extent of mouth opening, the range and deviation of mandibular movements, pain and tenderness over the joint area in the affected side (or in neck and shoulder muscles), presence of joint sounds and presence of malocclusion. Furthermore, panoramic radiography, and MRI were performed. All the examined patients fulfilled diagnostic criteria of internal derangement of TMJ as suggested by American Association of Oral and Maxillofacial Surgery in 1984. (AAOMS)[26], which include: 1) Pain or tenderness in the region of TMJ and muscles of mastication, 2) Severe trismus with maximum painless inter–incisal opening less than 30mm, 3) Limitation of the mandibular movement, 4) Deviation of the jaw toward the affected side during opening, 5) Sound during condylar movement (popping, crepitus, or clicking), and 6) Magnetic resonance imaging of TMJ shows evidence of anterior or anteromedial displacement of the meniscus. MRI images were obtained for patients in both closed and maximum painless mouth opening. Disc displacement was determined as the angulation at the junction of the posterior band of the disc and the bilaminar zone assumed from the 12 o'clock position in relation to the condyle. The 12 o'clock position was regarded

as the perpendicular line drawn from the midpoint of the condyle along the line connecting the summit of the articular eminence and the post glenoid process. Junctions lying within $10^{o} \pm 5^{o}$ from the 12 o'clock position were considered normal (Fig1).

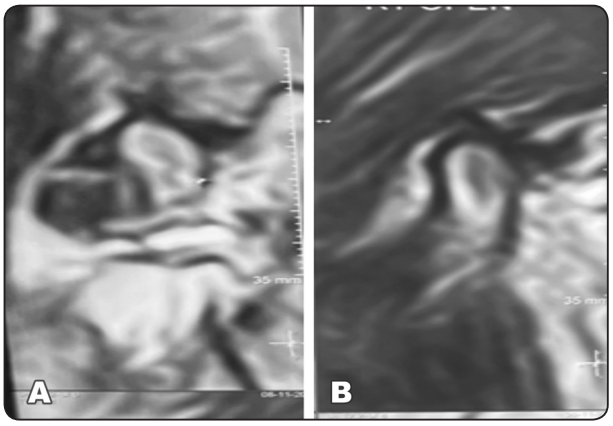

Fig. (1) MRI T2 weighted images in open mouth positions show A) anterior meniscal displacement, B) internal derangement with steepening of eminence anterior to dis with narrowing of space to disc movement

Surgical protocol

The partial eminectomy and meniscorhaphy was performed according to the surgical procedure for treatment of internal derangement described by Weinberg and Baldwin[2, 16]. A modified preauricular skin incision was made at 45^{o} to the zygomatic arch, from the superior auriculocutaneous junction. The incision should be made posterior to the line connecting the earlobe to the lateral canthus of the eye to avoid facial nerve injury. The incision was made through subcutaneous tissues to temporal fascia, then blunt dissection was made to a level of 20mm above the zygomatic arch and the flap was sutured forward. Additional dissection of superficial fascia from the temporal fascia is omitted to avoid injury to facial nerve branches. The superficial temporal fascia is incised 45' upward and forward, then at the formed pocket, the periosteum of the zygomatic arch is incised and retracted to expose articular eminence and articular fossa. The dissection progressed to the anterior border of the ear to separate the tissue from cartilage of the tragus (fig 2).

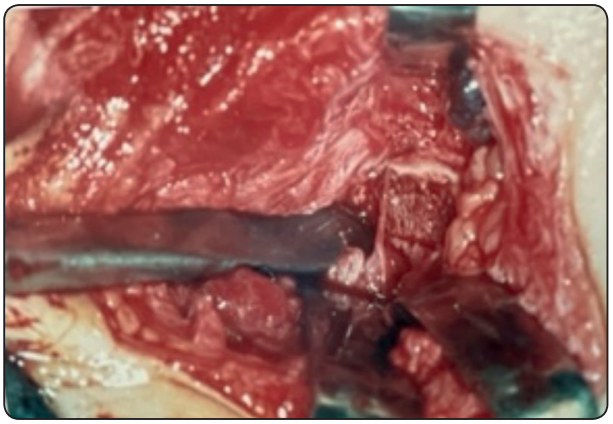

Fig. (2) Preauricular incision with blunt dissection in layers until reach the eminence and root of zygomatic arch and capsule does not open now as seen

The flap tissues are retracted anteriorly and downward. An elevator used to reflect the periosteum from the crest and distal slope of the eminence and from the surface of articular fossa. The firmly adhered fibrous disc in the superior compartment of the TMJ is separated from the distal slop with controlled force. The medial extent of the eminence is protected by thin retractor placed above and in front of the disc. Partial eminectomy is performed through extension of the supracapsular plane anteriorly up to the articular tubercle. Periosteal incision is made giving access to the eminence while the capsule is kept intact at such site. Chisels are used to remove-reshape the entire desired lateromedial posterior slope of the eminence. As 2-3mm reduction of the posterior slope of the eminence was done with fissure bur and removed with a sharp, thin osteotome and smoothening is carried out using hand or air driven bone files and rose-head bur (fig3).

The space of the upper compartment of the TMJ increased and the upper part of the disc and the stretched posterior attachment is visually seen. The lower compartment was opened by inverted L incision made through the posterolateral aspect of the capsule and the meniscus is dissected from the condyle of the mandible. The condyle is pushed

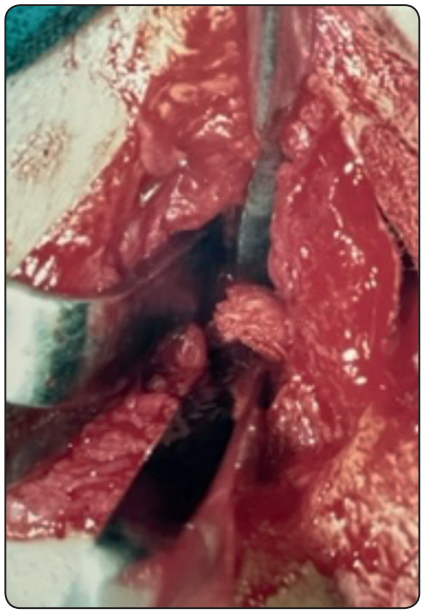

Fig. (3) Eminence is exposed and about 3 mm are removed from posterior articular surface of eminence with retraction of tissues as a whole with good protection of meniscus

Fig. (4) The wound sutured in layers and finished by subcuticular suturing

downward, and the disc is moved posteriorly to normal position. Great care was taken to prevent iatrogenic meniscaldamage. The lateral border of the disk is then directly sutured (plicated) to the lateral aspect of the capsule with 5-6 absorbable sutures (Vicryl) separated by 2 to 3 (meniscorhaphy/disc plication). The incisions were closed to seal the upper and lower compartments. The integrity of the suture lines was verified by manual movements of the mandible (opening, protrusive and lateral mandibular excursions). The wound was sutured in layers (fig 4), and a pressure dressing was applied for 48 hours.[16] Patients were instructed to limit jaw movement for 4 weeks to decrease tension on the sutured disc.

Patient evaluation

Clinical evaluation of mandibular movement, tenderness and joint sounds and patient subjective evaluation of pain and chewing ability were evaluated before surgery, 6 months and one year after surgery. Magnetic resonance imaging (MRI) was evaluated one year after surgery.

Clinical evaluation

The following parameters were evaluated, 1) maximum inter-incisal opening (in mm), 2) extent of protrusive excursions (in mm) 3), deviation of midline during mouth opening, 4) tenderness on palpation (in static, and during motion), and 5) Joint sound (popping, crepitus, clicking or grating).

Magnetic Resonance Imaging (MRI) evaluation

The following parameters were evaluated, 1) position of the meniscus, 2) morphology of the disc, and 3) Retrodiscal tissues and synovial fluid (fig 5).

Subjective patient outcomes

The following parameters were evaluated, 1) pain intensity: the intensity of pain was evaluated using the following scores; score 0; no pain, score 1; mild pain, score 2; moderate pain, and score 3; severe pain, 2) pain effect on life: was evaluated by selection of one of the following scores; score 0; no effect, score 2; slight effect, score 3; moderate effect, score 4; sever effect, and score 5 ; cannot function at all, 3) chewing ability; chewing ability

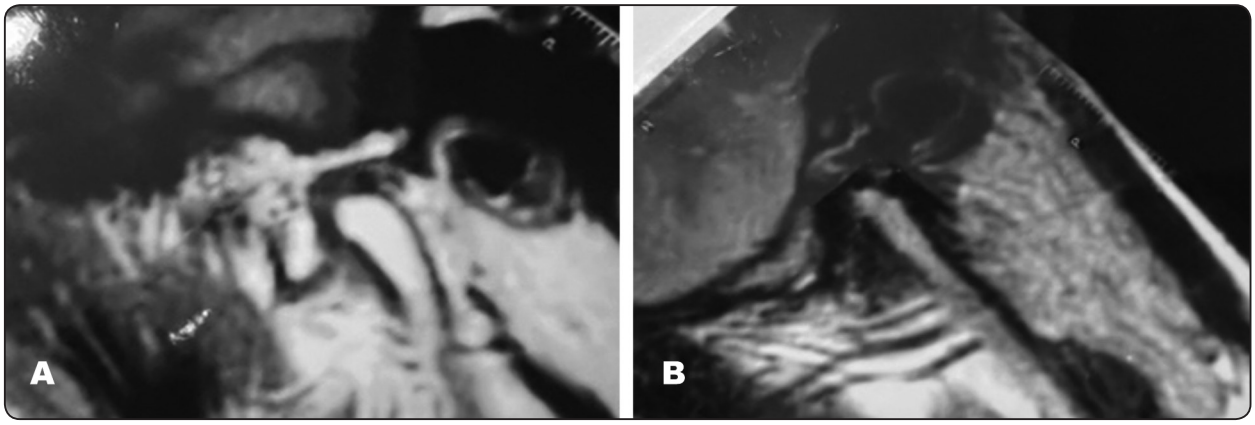

Fig. (5) MRI evaluation: A) preoperative anterior meniscal displacement with synovitis and abnormal morphology of retrodiscal tissues B) postoperative MRI show partial eminectomy and proper position and morphology of disc without synovial fluid efffusion.

was evaluated using frequency and percentage of individuals able to chew fluids, soft diet, and tough foods.

Statistical analysis

The data normality and distribution was verified by Shapiro wilk test. Comparison of maximum mouth opening, protrusive movements between time intervals was made by Repeated measures ANOVA followed by paired post hoc t-test. Comparison of TMJ tenderness, disc position and morphology, and pain effect on life between time intervals was made by Freidman test followed by Wilcoxon ranks test for multiple comparisons. Comparison of deviation toward affected joint, TMJ sounds, and retrodiscal tissues) between time intervals was made by Cochran's Q test (for more than 2 observation times) and McNamar tests (for only 2 observation times). Data analysis was performed with SPSS program (SPSS Inc., V. 22, Chicago, IL, USA). P is significant if < 0.05.

RESULTS

Comparison of mean maximal incisal opening, and protrusive movements (in mm) between observation times is presented in table 1. There was a significant difference in maximum interincisal opening and protrusive movements between observation times. Maximum interincisal opening and protrusive movements significantly increased from preoperative measurements to six months postoperatively, then significantly increased after 12 months compared to six months. Multiple comparison between observation times is presented in the same table. There was a significant difference in maximum incisal opening and protrusive movements between each two observation times. The overall increase in maximum incisal opening and protrusive movements after 12 months was 25.27 mm and 16.01 mm respectively.

Comparison of frequencies and percentage of deviation of midline during mouth opening between observation times is presented in table 2. There was a significant difference in frequencies of deviation of midline during mouth opening between observation times. Multiple comparison of frequencies of deviation of midline during mouth opening between time intervals is presented in the same table. Frequencies of deviation of midline during mouth opening significantly decreased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. However, there was no significant difference in deviation of midline between 6 and 12 months was observed.

TABLE (1) Comparison of mean maximal incisal opening, and protrusive movements (in mm) between observation times

	Maximal incisal opening		Protrusive movement	
	X	**SD**	**X**	**SD**
Pre-operative	24.58	2.36	10.36	**2.39**
6 months	43.98	3.15	23.29	**2.87**
12 months	49.85	2.78	26.37	**2.12**
Repeated ANOVA	**<.001***		**<.001***	
Preoperative– 6 months	**<.001***		**<.001***	
Preoperative – 12 months	**<.001***		**<.001***	
6 months – 12 months	**.004***		**.015***	

p is significant at 5%

Comparison of frequencies and percentage of TMJ tenderness between time intervals is presented in table 3. Preoperatively, moderate pain was recorded in one case, and the severe pain was recorded in 5 cases. Six months postoperatively, no pain was recorded with 4 cases, mild pain was recorded with one case, and moderate pain was recorded in one case. 12 months postoperatively, no pain was recorded with 5 cases and mild pain was recorded with one case. There was a significant difference in frequencies of TMJ tenderness between observation times. Multiple comparison of frequencies of TMJ tenderness between time intervals is presented in the same table. Frequencies of TMJ tenderness significantly decreased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. However, there was no significant difference in of TMJ tenderness between 6 and 12 months was observed.

TABLE (2) Comparison of frequencies and percentage of deviation of midline during mouth opening between observation times

		Frequency	Percentage
Preoperative	No deviation	0	**0%**
	deviation	6	**100%**
6 months	No deviation	5	**83.3%**
	deviation	1	**16.7%**
12 months	No deviation	5	**83.3%**
	deviation	1	**16.7%**
Cochran's Q test		**.007***	
Preoperative– 6 months		**0.047***	
Preoperative – 12 months		**0.047***	
6 months – 12 months		**1.00**	

p is significant at 5%

Table 4 shows comparison of frequencies and percentage of joint sounds between observation times. Preoperatively, 6 patients were recorded with Popping, clicking, Crepitation. Six months and 12 months postoperatively, 5 patients had no sounds and one patient had Popping and clicking sound. There was a significant difference in frequencies of joint sounds between observation times. Multiple comparison of frequencies of joint sounds between time intervals is presented in the same table. Frequencies of joint sounds significantly decreased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. However, there was no significant difference in of joint sounds between 6 and 12 months was observed.

TABLE (3) Comparison of frequencies and percentage of TMJ tenderness between observation times

		Frequency	Percentage
Preoperative	Moderate	1	16.7%
	Severe	5	83.3%
6 months	No	4	66.7%
	Mild	1	16.7%
	Moderate	1	16.7%
12 months	No	5	83.3%
	Mild	1	16.7%
Freidman test		.006*	
Preoperative– 6 months		0.038*	
Preoperative – 12 months		0.023*	
6 months – 12 months		0.128	

p is significant at 5%

TABLE (4) Comparison of frequencies and percentage of joint sounds between observation times

		Frequency	Percentage
Pre-operative	No sound	0	0%
	Popping, clicking, Crepitation	6	100%
6 months	No sound	5	83.3%
	Popping clicking	1	16.7%
12 months	No sound	5	83.3%
	Clicking	1	16.7%
Cochran's Q test		.007*	
Preoperative– 6 months		0.047*	
Preoperative – 12 months		0.047*	
6 months – 12 months		1.00	

p is significant at 5%

Comparison of frequency and percentage of disc position and morphology between observation times is presented in table 5. Frequency and percentage of normal disc position and morphology significantly increased after 12 months post-operatively compared to preoperative measurements. Comparison of frequency and percentages of normal retro discal connective tissues between observation times is presented in table 6. There was no significant difference in retro discal connective tissues after one year compared to preoperative measurements.

TABLE (5) Comparison of frequency and percentage of disc position and morphology between observation times

		Frequency	Percentage
Preoperative	Normal	0	0%
	ADD/normal shape	4	66.7%
	ADD/abnormal shape	2	33.3%
12 months	Normal	5	83.3%
	ADD/normal shape	1	16.7%
	ADD/abnormal shape	0	0%
Wilcoxon test		.020*	

p is significant at 5%

Table (6) Comparison of frequency and percentage of retro discal connective tissues between observation times

		Frequency	Percentage
Preoperative	Normal morphology	4	66.7%
	Abnormal morphology (herniation/tearing)	2	33.3%
12 months	Normal morphology	5	83.4%
	Abnormal morphology (herniation/tearing)	1	16.6%
McNamar test		.500	

p is significant at 5%

Comparison of frequency and percentage of pain intensity between observation times is presented in table 7. There was a significant difference in frequencies of pain intensity between observation times. Multiple comparison of frequencies of pain intensity between time intervals is presented in the same table. Frequencies of pain intensity significantly decreased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. However, there was no significant difference in of pain intensity between 6 and 12 months was observed.

Table (7) Comparison of frequency and percentage of pain intensity between observation times

		Frequency	Percentage
Preoperative	Moderate	2	33.3%
	Severe	4	66.7%
6 months	No	3	50%
	Mild	2	33.3%
	Moderate	1	16.7%
12 months	No	5	83.3%
	Mild	1	16.7%
Freidman test		.007*	
Preoperative– 6 months		0.034*	
Preoperative – 12 months		0.024*	
6 months – 12 months		0.083	

p is significant at 5%

Table 8. showed comparison of frequencies and percentages of Pain effect on life between observation times. There was a significant difference in frequencies and percentages of Pain effect on life between observation times. Pain effect on life significantly decreased at 6 months and 12 months compared to preoperative measurements. However, no significant difference in Pain effect on life between 6 months and 12 months was observed.

Comparison of frequencies and percentage of chewing ability between observation times is shown in table 9. There was a significant difference in frequencies and percentages of chewing ability between observation times. Chewing ability significantly increased at 6 months and 12 months compared to preoperative measurements. However, no significant difference in chewing ability between 6 months and 12 months was observed.

Table (8) Comparison of frequencies and percentage of Pain effect on life between observation times

		Frequency	Percentage
Preoperative	Not function at all	1	16.7%
	Severe effect	5	83.3%
6 months	No effect	4	66.7%
	Mild effect	1	16.7%
	Moderate	1	16.7%
12 months	No effect	5	83.3%
	Mild effect	1	16.7%
Freidman test		.006*	
Preoperative– 6 months		0.038*	
Preoperative – 12 months		0.023*	
6 months – 12 months		0.157	

p is significant at 5%

TABLE (9) Comparison of frequencies and percentage of chewing ability between observation times

		Frequency	Percentage
Preoperative	Fluids	1	16.7%
	Soft diet	5	83.3%
6 months	Tough food	5	83.3%
	Soft diet	1	16.7%
12 months	Tough food	5	83.3%
	Soft diet	1	16.7%
Freidman test		.008*	
Preoperative– 6 months		0.048*	
Preoperative – 12 months		0.047*	
6 months – 12 months		0.157	

p is significant at 5%

DISCUSSION

The majority of the included patients in this study were females as it has been demonstrated that females are more prone to meniscal displacement progressing to surgery[27]. Moreover, a psychological, and social association was found between meniscal displacement and females [28, 29]. In this study, magnetic resonance imaging was used for diagnosis of meniscal displacement as it has been reported that MRI is sensitive and specific imaging technique in diagnosis of anterior meniscal displacement and osseous changes in TMJ[30]. Moreover, MRI is recommended mainly in severe, therapy-resistant cases which don't respond to conservative treatment and need surgical intervention[30]. Moreover, measurement of position of the meniscus of the TMJ using MRI helps in establishing response to treatment for internal derangements of the TMJ[31]

Open surgery and arthroscopy are common surgical techniques used to manage patients with meniscal displacement. Although arthroscopic meniscal repositioning is minimally invasive and accepted by the patients[32], it is effective only in less severe cases of deformation[33] and may induce long term disc degeneration[33]. Consequently, open joint surgery was used in this study rather than arthroscopic disc repositioning to eliminate adhesions[34], and correct severely deformed discs[35, 36].

Although several surgical techniques have been used for surgical treatment of meniscal displacement, the superiority of a specific surgical technique to another still needed to be to be determined[2,3,9]. Moreover, the efficacy of combination of two techniques together in treatment of meniscal displacement still need further investigation. Accordingly, this study investigated clinical, MRI findings, and patient-based outcomes of partial eminectomy with meniscoraphy in the treatment of meniscal displacement of TMJ.

In this study, partial eminectomy with meniscoraphy was associated with improved maximum interincisal opening and protrusive movements, reduced deviation of midline during mouth opening, TMJ tenderness, and joint sounds. The MRI showed normal disc position and morphology after one year. The subjective evaluation of patient indicated significant reduction of pain intensity, and pain effect on life with increased chewing ability. This indicate the clinical success of eminectomy procedure which is measured by the following criteria: reduction in pain, improvement in function (mouth opening and chewing) and reduction in clicking.[37] These improvements could be attributed to the partial eminectomy procedure which allows increase in the intra-articular space, reduction of the vacuum, creates larger anterior recess in the superior joint space[3], and removes the physical barrier to articular disc activity without trapping of the bilaminar zone[3] and provide joint decompression[10, 16]. Consequently, unrestricted movement of the disc without entrapment the posterior attachment occurs. In addition, the meniscoraphy (disc plication to the lateral aspect of the capsule) providing long term stabilization of the meniscus without damaging the unique structure of the condylar head [3, 15]. It has been reported that eminectmy can eliminate mechanical interference and facilitates a smooth functioning surface for the joint translation without interference with the internal joint mechanism.[37] One of the advantages of the eminectomy surgical procedure compared to other open surgeries is the reduced recurrence rates [38].

Maximum interincisal opening and protrusive movements significantly increased from preoperative measurements to six months postoperatively, then significantly increased after 12 months compared to six months. The improvement in maximal interincisal opening and protrusive movements was in line with the findings of Baldwin and Cooper[2] who reported improved joint mobility and increased interincisal mobility in 71% of cases after eminectomy and meniscal plication in patients with meniscal displacement of TMJ after 2 years. However, the authors reported increased inter-incisal distance only by 7%. They attributed this to the cases that had no improvement or worsened after surgery. In contrast,

in our study all cases showed improvement in interincisal opening and protrusive movement. This may be due to partial eminectomy overcomes the problems of total eminectomy as fibrous adhesions that may occur between the disc and the bloody surface of the reduced articular eminence and reduce inadequate disclusion of the buccal segments in protrusive and lateral mandibular excursions[10]. In the study of Baldwin and Cooper[2], the limited improvement of mouth opening could be attributed to the total eminectomy which creating fibrosis and scar tissue in the capsule and surrounding areas. Similar to our finding, another study[10] reported improvement in jaw movement restriction after 6 months of surgery when disc repositioning plus temporal eminectomy was used compared to disc repositioning alone. Our results are also in agreement with findings of Williamson et al.[3] who performed true eminectomy with type III or IV anteriorly displaced discs and found significant increase in maximum interincisal opening in 95% of patients (range 5–20 mm, mean 12 mm) after 12 months postoperatively.

Frequencies of deviation of midline during mouth opening, TMJ tenderness, joint sounds significantly decreased from preoperative measurements to six months postoperatively, and from preoperative measurements to 12 months postoperatively. The reduced deviation of midline during mouth opening after performing partial eminectomy with mensicoraphy is in agreement with finding of another author[25] who reported significant improvement of mandibular deviation after eminectomy in combination with discorrhaphy and disc repair. The author reported that this improvement was significantly higher than cases of internal derangements treated by high condylectomy. The reduced TMJ tenderness may be attributed to the reduced joint inflammation and pain after performing eminectomy[39]. The significant decrease in joint noise after partial eminectomy and meniscoraphy is in agreement with findings of other study[2] in which the authors reported improvement joint sounds in 63% of cases after total eminectomy with disc plication in patients with meniscal displacement of TMJ after 2 years.

Frequency and percentage of normal disc position and morphology significantly increased after 12 months post-operatively compared to preoperative measurements. In line with our finding, Williamson et al.[3] used postoperative orthopantomograph and MRI radiographic evaluation and found significant improvement in position and morphology of the meniscus with significant increase in rotation and translatory movement of the condylar head after performing true eminectomy with type III or IV anteriorly displaced discs. They concluded that this procedure is a successful treatment for patients who did not respond to conservative treatment after one year.

Frequencies of pain intensity, and pain effect on life significantly decreased, and chewing ability significantly increased from preoperative measurements to six and 12 months postoperatively. However, there was no significant difference in these parameters between 6 and 12 months was observed. The reduction of intensity of pain and effect of pain on life was in line with finding of another study[2] which reported 65% improvement in pain (recorded in questionnaires) following total eminectomy with disc plication in patients with meniscal displacement. Despite of significant improvement in patient-based outcomes, one patient still has problem in pain intensity, pain effect on life, and chewing ability after 12 months. This patient was a female one who was subjected to sever psychological stress. In agreement with our finding, Eppley and Delfino[25] reported less residual pain when eminectomy was performed with discorrhaphy and disc repair. The persistence of pain in one case agreed with the finding of Candirli et al.[40] who noted that discectomy was superior to eminectomy in reducing pain and improving joint function. Similarly, the authors in another study[2] reported high patient satisfaction with TMJ surgery, despite the lack of total resolution of symptoms. However, overall improvement in patient-based outcome (pain-chewing ability)

was in line with the finding Baldwin and Cooper[2] who reported that 93% of patients underwent eminectomy with disc repositioning were satisfied with the treatment and willing to undergo surgery again. In agreement with our findings, Williamson et al.[3] evaluated Mandibular Functional Impairment and Clinical Dysfunctional Index using a questionnaire filled by the patients after 12 months after of performing true eminectomy with type III or IV anteriorly displaced discs. The authors found a significant improvement in symptoms, in 85% of investigated patients.

The study limitations include small patient sample and the short follow up period. Another limitation is the lack of control group which include total eminectomy that should be compared with test group (partial eminectomy) in combination with disc repositioning and plication. Therefore, a future randomized trial with sufficient sample size and long observation time still needed to compare the outcomes of partial eminectomy with total eminectomy.

CONCLUSION

Within the limits of this short-term prospective study, partial eminectomy with meniscorhaphy is considered an effective surgical treatment of meniscal displacement as it improves clinical outcomes, MRI findings and patient-based outcomes after 12 months of surgery.

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