

Diagnostic and Therapeutic Effect of Endoscopically Assisted Arthrocentesis to Improve the Mobility of the Mandible in Internal Temporomandibular Joint Disorders

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ABSTRACT

Objective: To compare the diagnostic and therapeutic effect of endoscopically assisted arthrocentesis with conventional arthrocentesis and arthroscopy.

Material and Methods: 372 TMK examinations and treatments were performed from January 2019 to April 2021 (27 months). We monitored the pain level on the VAS scale, the extent of interincisal distance, and the value of NMR scans before and after treatment.

Results: By comparing the results of clinical examination, graphical imaging and statistic evaluation of conventional arthrocentesis under local anesthesia, conventional arthroscopy under general anesthesia, and innovative endoscopic-assisted single cannula three-way arthrocentesis under local anesthesia, it can be seen that the postoperative interincisional distance and grade values for pain after surgery are better for surgical procedures under local anesthesia with the innovative endoscopic-assisted single cannula three-way technique. Particularly significant are the improved values for the larger range of interincisional distance.

Conclusion: By assessing the intraarticular structures based on NMR examinations and the Wilkes classification scheme, we found that all minimally invasive procedures resulted in improved pathologies. Based on clinical experience, we can conclude that the innovative endoscopically assisted single cannula three-way arthrocentesis under local Anaesthesia is superior to conventional arthroscopy under general Anaesthesia and conventional arthrocentesis under local Anaesthesia.

Introduction

The craniofacial region is one of the most innervated areas of the human body and a place where pain is quite often renewed - from the common headache to unusual and difficult to explain pain, e.g., trigeminal neuralgia. One group of disorders in that location that may concern a person not only because of painful symptoms, but also because of several other difficulties, is a set of disorders affecting the temporomandibular/temporomandibular joint and the surrounding tissues, and it can be said that roughly 60% of the population suffers from any disorder of the function of this joint. The specificity of this joint lies in its localization, where the articular fossa is located at the base of the skull and the articular head forms part of the mandible. Between these two structures there is a ligamentous plate called the disc, which is most often affected by the pathological process. In the treatment of TMJ pain, conservative methods are used first. If these methods are unsuccessful, the pain can be treated with minimally invasive surgical techniques. This step should be taken before the pain becomes chronic. Early surgical intervention is essential to prevent the pain from worsening in patients. Endoscopic procedures are indicated for disc dislocation, arthrosis, and for functional disorders caused by periarticular fractures. Endoscopes provide magnified and detailed images of changes in cartilage, bone, ligaments, and synovial membrane. In addition to the beneficial effects of arthrocentesis, this endoscopic

procedure also allows the removal of minor adhesions.

Material and Methodology

At the Department of Dentistry and Maxillofacial Surgery of the Jessenius Medical Faculty of Comenius University and University Hospital in Martin, 90 TMJs were examined and treated by conventional double-cannula arthroscopy under general Anaesthesia between January 2019 and April 2021 (over a period of 27 months) (Figure 1). By conventional arthrocentesis under local Anaesthesia, 90 TMK were examined and treated (Figure 2). In the same period, 192 TMK were examined and treated under local Anaesthesia with an innovative single cannula three-way system - endoscopically assisted arthrocentesis (Figure 3). In total, 372 TMKs were examined and treated. Among the diagnoses, anterior disc dislocation without repositioning -Wilkes classification III was predominant. To objectify the results, we used clinical examination of the patients, monitored the degree of pain before treatment and during the follow-up period according to the VAS pain scale, and made measurements of the interincisal distance between the upper and lower middle incisors. By palpation and auscultation of the external auditory canal, we detected the presence or absence of sound phenomena. We compared the MRI (magnetic resonance imaging) scans of the TMJ of the patients performed before and after treatment.



Figure 1: Double-cannular arthroscopy.



Figure 2: Arthrocentesis.

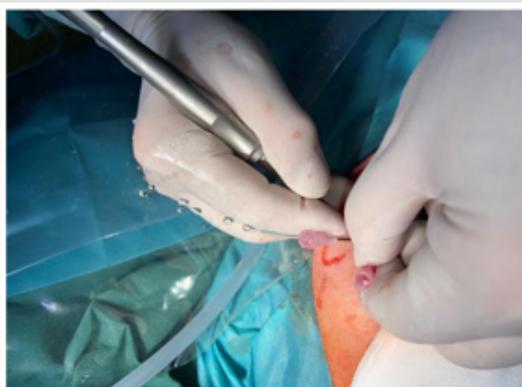


Figure 3: Three-way single cannula set for arthrocentesis.

Achieved Results

In our clinic, in the jaw joint pain clinic, we clinically examined and subsequently treated patients with disorders of the disc-condylar complex. The patients were divided into three groups. The first group were patients who underwent an innovative endoscopically assisted single cannula three-way arthrocentesis under local anesthesia for a total of 192 TMK (102 on the right and 90 on the left, Chart 1). The range of interincisal distance before treatment was on average 25mm, after treatment the range of interincisal distance improved to 40mm (Chart 2). While the degree of pain before treatment was at a value of No. 7 on the VAS scale, after treatment, this degree was lowered to a value of No. 3 (Chart 2). By comparing the imaging scans (NMR) before and after

treatment, we concluded that there was an improvement in the Wilkes' classification pathology scores, which is shown in (Chart 3). Charts 2 & 3 shows the improvement of the pathological states within the Wilkes classification, the improvement of the range of the interincisal distance of mouth opening and the lowered of the grade for pain. The second group were patients who were treated with conventional arthrocentesis under local anesthesia. These were 90 TMJs (48 on the right and 42 on the left, Chart 4). The range of interincisal distance was on average 29mm before treatment, after treatment the range of interincisal distance improved to 36mm (Chart 5). While the degree of pain before treatment was at a value of No. 7 on the VAS scale, after treatment, this degree was lowered to a value of No. 4 (Chart 5).



Chart 1: Single cannula three-way arthrocentesis under local anaesthesia.

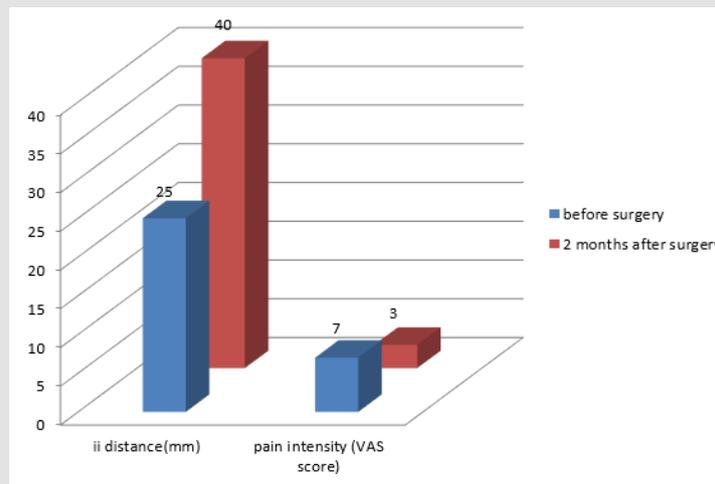


Chart 2: Single cannula three-way treatment technique - clinical data.

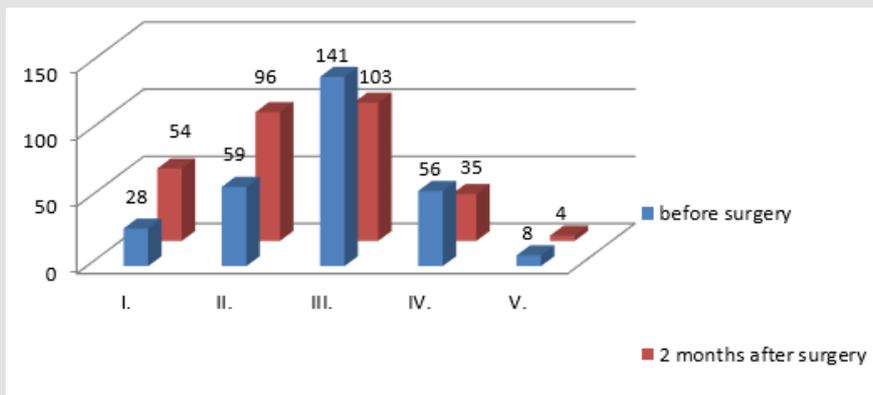


Chart 3: Single cannula three-way treatment technique - Wilkes classification.

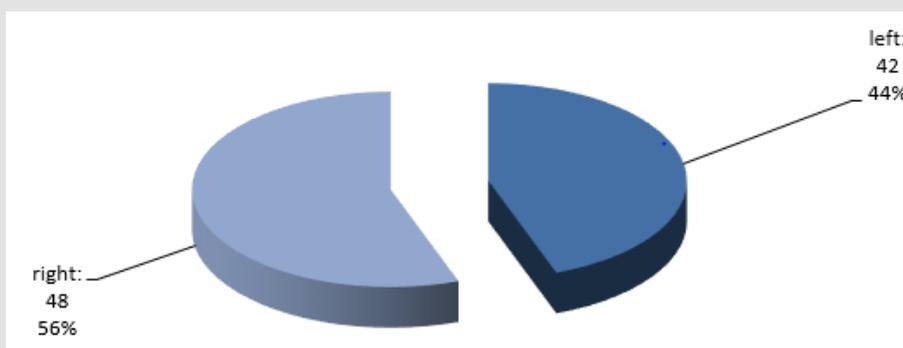


Chart 4: Conventional arthrocentesis under local anaesthesia 90 temporomandibular joints.

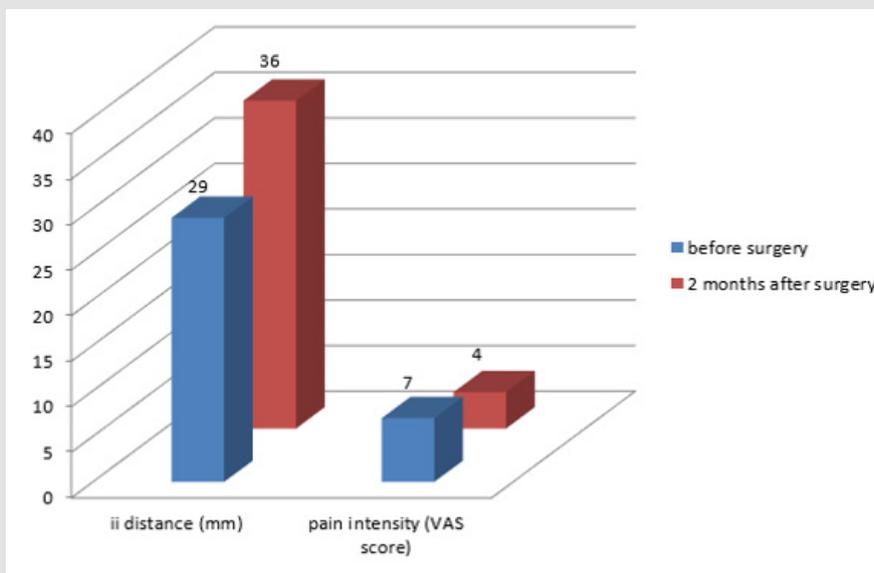


Chart 5: Conventional arthrocentesis - clinical data.

By comparing the imaging scans (NMR) before and after treatment, we concluded that there was a modification of the pathologically altered intra-articular structures according to the Wilkes classification scheme, which is shown in (Chart 6). The third group was patients who were treated by conventional arthroscopy under general anesthesia. These were 90 TMJs 50 on the right and 40 on the left, (Chart 7). The range of interincisal distance was on average 29mm before treatment, after treatment the range of interincisal distance improved to 38mm (Chart 8). On the VAS scale for pain, the mean value was at No. 7, after treatment this grade was lowered to No. 4 (Chart 8). By comparing the imaging scans (NMR) before and after treatment, we concluded that there

was improvement and modification of the pathologically altered intra-articular structures of the TMJ within the Wilkes grading scheme (Chart 9). By comparing the results of clinical examination and graphic imaging of conventional arthrocentesis under local anesthesia, conventional arthroscopy under general anesthesia, and innovative single cannula three-way arthrocentesis under local anesthesia, it can be seen that the postoperative values of interincisal distance and the grade values for postoperative pain are better in the case of surgical procedures under local anesthesia with the innovative endoscopy-assisted single cannula three-way technique. Particularly significant are the improved values of the greater range of interincisional distance (Chart 10).

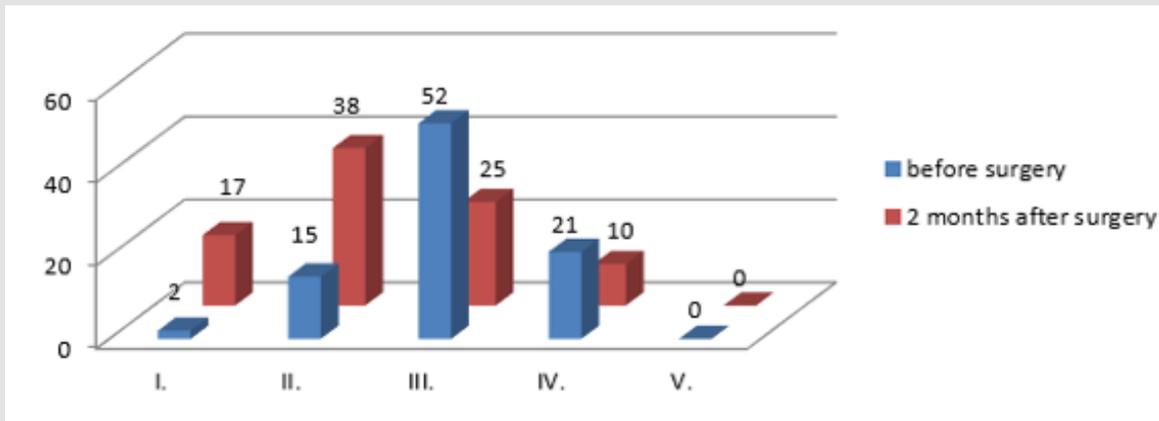


Chart 6: Conventional arthrocentesis - Wilkes classification.

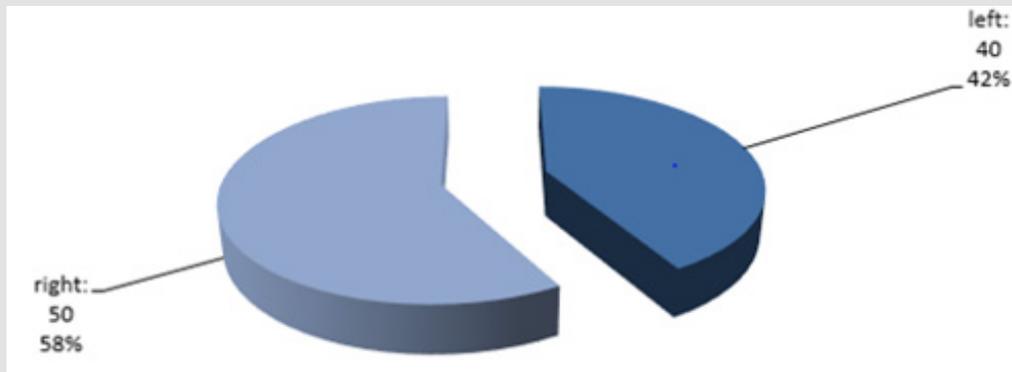


Chart 7: Conventional arthroscopy under general anaesthesia 90 TMK.

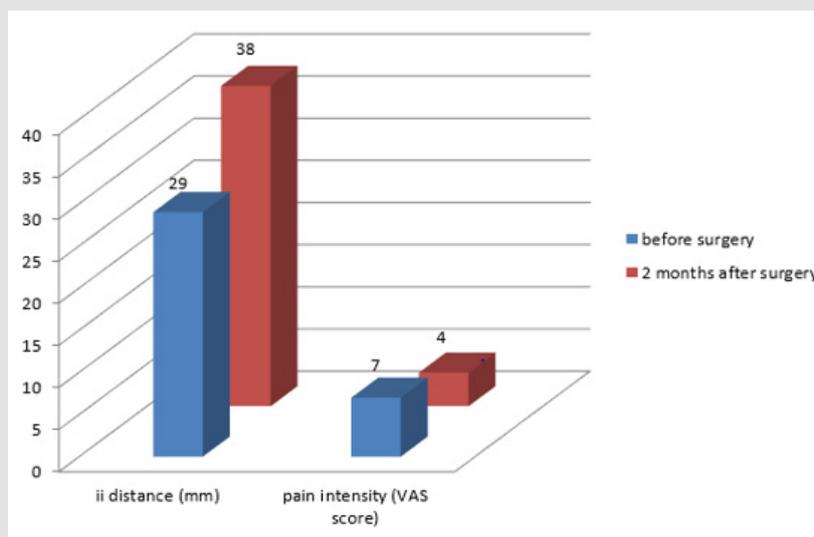


Chart 8: Conventional arthroscopy - clinical data.

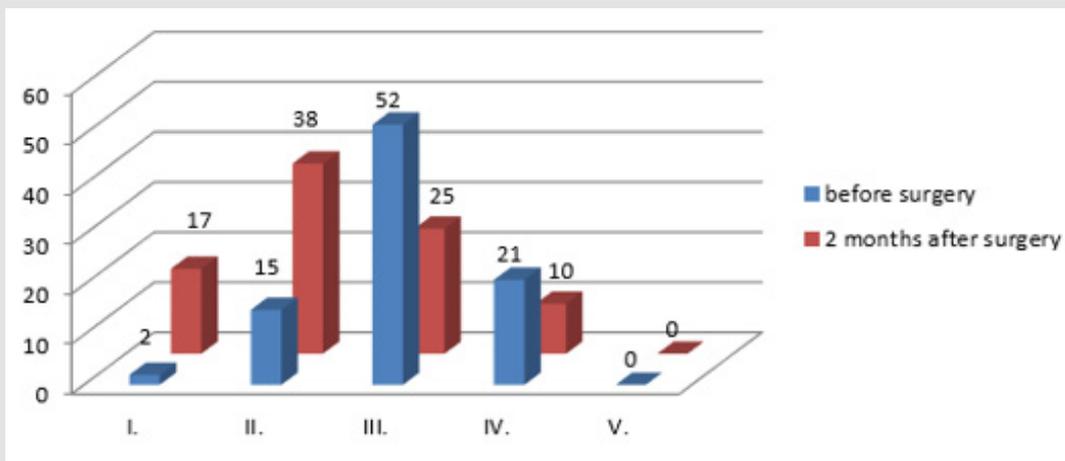


Chart 9: Conventional arthroscopy - Wilkes classification.

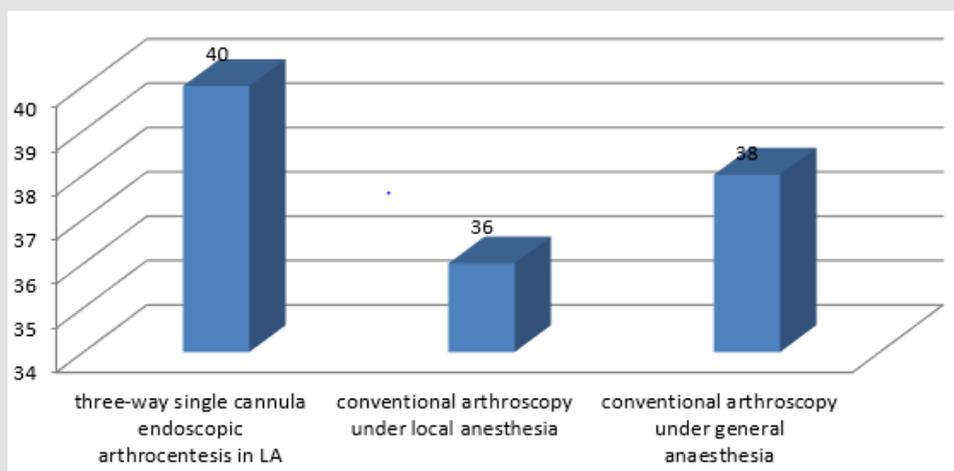


Chart 10: Interincisal distance values at 2 months after treatment (mm).

Statistical Evaluation

Questions

1. Inter incisal distance improvement (before- after), was it better in group1 relative to group2, group?

2. Change in pain, was it different between groups?

3. Change in Wilkes classification, was it different between groups? (Table 1).

Table 1.

Characteristic	Group1, N = 192 ¹	Group2, N = 90 ¹	Group3, N = 90 ¹
Side			
L	90 (47%)	42 (47%)	40 (44%)
P	102 (53%)	48 (53%)	50 (56%)
ii_distance_before	25.0 (0.83)	29.0 (1.42)	29.0 (0.98)
ii_distance_after	40.1 (0.75)	36.0 (1.25)	38.0 (0.70)
ii_distance_before_minus_after	-15.0 (1.13)	-7.0 (1.90)	-9.1 (0.86)

Pain_Before			
5	2 (1.0%)	0 (0%)	2 (2.2%)
6	24 (12%)	15 (17%)	16 (18%)
7	148 (77%)	60 (67%)	53 (59%)
8	18 (9.4%)	15 (17%)	19 (21%)
Pain_After			
2	16 (8.3%)	2 (2.2%)	0 (0%)
3	161 (84%)	10 (11%)	11 (12%)
4	15 (7.8%)	66 (73%)	65 (72%)
5	0 (0%)	10 (11%)	14 (16%)
6	0 (0%)	2 (2.2%)	0 (0%)
Pain_before_minus_after			
0	0 (0%)	1 (1.1%)	0 (0%)
1	0 (0%)	2 (2.2%)	2 (2.2%)
2	4 (2.1%)	20 (22%)	11 (12%)
3	33 (17%)	44 (49%)	66 (73%)
4	123 (64%)	19 (21%)	11 (12%)
5	32 (17%)	4 (4.4%)	0 (0%)
Wilkes_before			
I	14 (7.3%)	2 (2.2%)	2 (2.2%)
II	32 (17%)	15 (17%)	13 (14%)
III	121 (63%)	52 (58%)	54 (60%)
IV	21 (11%)	21 (23%)	21 (23%)
V	4 (2.1%)	0 (0%)	0 (0%)
Wilkes_after			
I	30 (16%)	16 (18%)	17 (19%)
II	65 (34%)	39 (43%)	37 (41%)
III	85 (44%)	25 (28%)	26 (29%)
IV	10 (5.2%)	10 (11%)	10 (11%)
V	2 (1.0%)	0 (0%)	0 (0%)
Wilkes_before_minus_after			
-1	14 (7.3%)	1 (1.1%)	1 (1.1%)
0	99 (52%)	32 (36%)	37 (41%)

1	64 (33%)	50 (56%)	39 (43%)
2	15 (7.8%)	7 (7.8%)	12 (13%)
3	0 (0%)	0 (0%)	1 (1.1%)

Note: ¹n (%); Mean (SD)

Q1: ii Distance Improvement (Before - After); was it Better in Group1 Relative to Group2, Group3?

One-Way ANOVA

1. The mean decrease of ii (before minus after) in group1 was -15; The mean decrease of ii (before minus after) in group2 was -7;

The difference between the change in group1 and group2 was thus 8, and the difference was significant (pval = 0).

2. The mean decrease of ii (before minus after) in group1 was -15; The mean decrease of ii (before minus after) in group3 was -9.1; The difference between the change in group1 and

group3 was thus 5.9, and the difference was significant (pval = 0).

3. The mean decrease of ii (before minus after) in group2 was -7; The mean decrease of ii (before minus after) in group3 was -9.1; The difference between the change in group1 and group2 was thus 2.1, and the difference was significant (pval = 0).

Q2: Change in Pain; was it Different Between Groups?

Cochran Armitage Test of Trend

1. g1 vs g2 as the difference (of pain before minus after) increases, the percentage of group2 relative to group1 decreases. The decrease is statistically significant (pval = 0).
2. g1 vs g3 as the difference (of pain before minus after) increases, the percentage of group3 relative to group1 decreases. The decrease is statistically significant (pval = 0).
3. g2 vs g3 as the difference (of pain before minus after) increases, the percentage of group3 relative to group2 is not statistically significantly different (pval = 0.69).

Q3: Change in Wilkes; was it Different Between Groups?

Cochran Armitage Test of Trend

1. g1 vs g2 as the difference (of Wilkes before minus after) increases, the percentage of group2 relative to group1 increases. The increase is statistically significant (pval = 0.001). NOTE: the proportion remains below 0.5.
2. g1 vs g3 as the difference (of Wilkes before minus after) increases, the percentage of group2 relative to group1 increases. The increase is statistically significant (pval = 0.0008). NOTE: the proportion remains below 0.5.
3. g2 vs g3 as the difference (of Wilkes before minus after) increases, the percentage of group3 relative to group2 is not statistically significantly different (pval = 0.83).

Discussion

Therapeutic procedures in the TMJ area are usually performed under local anesthesia (Fazal, et al. [1-4]). If general anesthesia is necessary, we must prevent spastic perimandibular muscle contractions in the immediate postoperative period, which are associated with reflex contraction of the pharyngeal muscles (Campos, et al. [5,6]). In the treatment of chronic facial pain, to relieve muscle tension or spasm, some authors use the application of steroid hormones (Dione, et al. [7]). The effect of exogenously administered hyaluronic acid to stimulate the endogenous form of hyaluronic acid has already been written about. Hyaluronate can also serve as an intra-articular lubricant to improve mobility in the joint space while minimizing intra-articular damage (Guarda-

Nardini, et al. [8-10]). Due to its minimal invasive, arthroscopy is associated with minimal complications (Nishimura, et al. [11,12], Hard 2015). The use of a single cannula in the OSCA technique results in even less invasive than the traditional two-port - two-cannula arthroscopy technique (Nitzan, et al. [12-15], Melo 2017). The cartilage that covers the surface of the eminence articularis is the most susceptible to iatrogenic damage. This damage is one of the most common complications during arthroscopy. Exploratory movements in the articular cavity can cause loosening of pieces of cartilage into the upper joint space. If this damage is more pronounced, it can limit visibility and lead to misdiagnosis of chondromalacia (Griffits, et al. [4,6,16-18]). An important part of arthroscopy is lavage or the washing away of mediators of sterile inflammation. Several authors in their studies point out the success and effectiveness of arthrocentesis on improving the range of mouth opening movements, reducing the degree for pain (Guarda-Nardini, et al. [8,19,20]). Nitzan and colleagues [12,21] in their works state that symptoms affect the function of the joint, but on the other hand, the age of the patient does not affect the method and type of arthrocentesis performed.

Platelet concentrates prepared from the patient's own blood accelerate cartilage healing and regeneration. Several studies have concluded that platelets provide better clinical results compared to hyaluronic acid in the symptomatic relief of mild to moderate osteoarthritis. For therapeutic purposes of TMJ disorders, platelets must be in the form of a solution as they are administered by injection. Some authors such as (Al-Delayme, et al. [5,22-24]) conducted a study to evaluate the effect of platelet application compared to other treatments. Even with the use of the single cannula three-port technique, either the temporal branch or the zygomatic branch of the n. facialis can be injured. Injury to the temporal branch results in the inability to raise the eyebrow, whereas injury to the zygomatic branch results in the inability to close the eye firmly. The duration of nerve weakness ranges from 1 week to 6 months (Ferber, et al. [25]). Sometimes perforation of the tympanic membrane may occur. This complication should be managed in collaboration with an otologist (Srouji, et al. [15]). More common complications include injury to the vessels of the artery and vena temporalis superficialis. In these cases, the use of controlled pressure is sufficient. Laceration of the medial pterygoid artery can also occur, leading to hamartrosis. Hamartrosis prolongs healing and accentuates postoperative discomfort. It increases the risk of adhesions and fibrous type ankylosis, resulting in limited range of motion of the sleeve (Indresano, et al. [17]).

In case of failure or breakage of the instrument, it is a good idea to remove the instrument immediately. If this is not possible a second attempt should be made as soon as possible within 6

weeks. It goes without saying that the patient must be informed about the risk of future osteoarthritis and infection (Machon, et al. [26,27]). By comparing the results of clinical examination, graphical imaging and statistical evaluation, it can be seen that the postoperative interincisal distance and grade values for pain after surgery are better in the case of surgical procedures under local Anaesthesia using the single cannula technique. It can be said that the endoscopic one-cannula technique under local anesthesia is more advantageous than the conventional endoscopic two-cannula technique under general anesthesia and conventional arthrocentesis under local anesthesia [28-40].

Conclusion

By assessing the intra-articular structures on the basis of NMR examinations and the Wilkes classification scheme, we found that all minimally invasive procedures resulted in improvement of pathological conditions. Based on clinical experience, we can conclude that the innovative endoscopically assisted single cannula three-way arthrocentesis under local anesthesia is superior to conventional arthroscopy under general anesthesia and conventional arthrocentesis under local anesthesia. The advantages are mainly that the patient is treated under local anesthesia, we have optical visualization of the intra-articular space, it is an outpatient procedure, there is no need for preoperative examination of the patient, and there is no need for hospitalization of the patient. There are not two scars but only one scar. The clear economic advantages of this innovative single cannula technique are also an important factor.

Confirmation of Authorship

1. Author confirms that all the authors have had material input into the submission.
2. Knowledge all the authors, all the claims, statements and conclusions are true and jointly held opinions.
3. Author confirms that accept the terms of publication of the publisher.

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