J Oral Med Oral Surg 2022;28:3
https://doi.org/10.1051/mbcb/2021037

https://www.jomos.org

JOMOS
Journal of Oral Medicine and Oral Surgery

Original Research Article

Influence of the type of anesthesia on 111 arthrocentesis in temporomandibular joint disorders: results of a prospective study

Marina A. Gavin Clavero[1,*], M. Victoria Simón Sanz[2], Eduard Mirada Donisa[1], Rocio Gallego Sobrino[2], Leire Esparza Lasaga[2]

[1] Department of Oral and Maxillofacial Surgery, University Hospital Joan XXIII, Tarragona
[2] Department of Oral and Maxillofacial Surgery, University Hospital Miguel Servet, Zaragoza

(Received: 19 March 2020, accepted: 14 September 2021)

Keywords: Anesthesia / arthrocentesis / midazolam / propofol

Abstract – Aims: Temporomandibular dysfunction is a generic term that covers a large number of clinical problems affecting not only TMJ (Temporomandibular Joint), but also the masticatory musculature and related structures. Arthrocentesis is the most commonly used technique in patients with pain or limitation of the oral opening due to joint causes in which conservative treatment has failed. It is generally performed under local anesthesia and sedation, although depending on the type of patient and the preferences of the surgeon it can also be performed under general anesthesia. **Material and method:** A prospective, observational, analytical cohort study has been carried out to evaluate if the type of anesthesia, the drugs used for sedation and whether or not anesthetic induction is performed during arthrocentesis influence the results of 111 arthrocentesis performed in patients with TMJ pathology. **Results:** In patients who arthrocentesis was performed with propofol without midazolam the improvement in pain at one week and one month postarthrocentesis was greater than propofol with midazolam was used. **Conclusion:** The type of anesthesia could influence the results of arthrocentesis.

Introduction

TMJ dysfunction is a generic term that includes a large number of clinical problems affecting not only the TMJ, but also the masticatory muscles and related facial structures. It is an alteration of the articular function, in which normal relations between the articular disc with the condyle and the articular eminence are modified [1,2]. Among the temporomandibular joint dysfunctions, we can identify disc pathologies (displacements of the articular disc) and intraarticular TMJ pathologies (capsulitis, synovitis, retrodiscitis, osteoarthritis, osteoarthrosis, intraarticular free bodies) [3,4]. In patients with pain or limitation in oral opening due to articular causes, arthrocentesis is the most commonly used technique when conservative treatment has failed regardless of the type of pathology and the clinical stage of temporomandibular dysfunction [5–7]. It is a simple, economic and basic technique, with a not very high learning curve performed by maxillofacial surgeons with hardly any side effects, which improves the quality of life of patients [8]. It is generally performed under local anesthesia and sedation, although depending on the type of patient and the preferences of the surgeon it can also be performed under general anesthesia. In some studies, the improvement was greater when general anesthesia was used being able to perform greater amplitude of maneuvers and jaw movements [9,10].

However, the influence in arthrocentesis results of anesthetic induction before sedation and the type of drugs used during sedation has not been yet studied.

The aim of this study is to assess whether the type of anesthesia and sedation used during arthrocentesis influences the results in pain and oral opening at one week and one month postarthrocentesis.

Material and methods

A prospective, observational, analytical cohort study of 111 arthrocentesis on patients with TMJ pathology has been performed. This study has been carried out from January 2014 to July 2017 in oral and maxillofacial surgery department in a

* Correspondence: marinagvncla@gmail.com

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public university hospital, evaluating the influence of the drugs used during sedation in the results of temporomandibular arthrocentesis after one week and one month.

The inclusion criteria were: patients with pain and/or joint block with limitation in oral opening without response to hygienic dietary measures (patient education and self-care, behavior modification, parafunctional habits: teeth clenching, nail biting, yawning; anti-inflammatory drugs and muscle relaxant; physiotherapy) after one to three months period. There are not age limits. These patients were treated with temporomandibular arthrocentesis under general anesthesia or under local anesthesia and sedation after a signed consent. As exclusion criteria we have established: exclusive muscular pathology, patients with previous jaw fractures, disabling psychological factors and previous intra-articular surgical interventions.

For the purpose of this study the following dependent variables (outcome) have been used: pain measured in EVA scale from 1 to 10 (ordinal qualitative variable). The oral opening, measured in millimeters (continuous quantitative variable, which we transform into qualitative dichotomous whether the improvement was greater or less than 5 mm).

We have used as independent variables: the type of anesthesia, the drugs used for sedation and whether or not anesthetic induction is performed during arthrocentesis. The type of sedation used was aleatory. The patients and those who assessed the results were blinded by the drugs used during sedation.

The drugs administered during sedation were aleatory but not blinded and the data of the drugs was collected from the anesthesia graphs by different evaluators. The results in pain and oral opening were collected after arthrocentesis without knowing the type of sedation administered during the intervention.

The arthrocentesis was performed by four maxillofacial surgeons with experience in TMJ pathology and the information was collected by the same maxillofacial surgeon who did not perform the arthrocentesis.

For the statistical analysis of the collected data, a bivariate study has been conducted using the statistical software SPSS 20.0. The variables do not follow a normal distribution and the exact statistic of Fisher was followed. The significance level was $p \leq 0.05$.

This article was approved by University Hospital review board and the informed consent was obtained in all patients operated.

Results

111 arthrocentesis on patients with TMJ pathology has been performed. The percentage of women was 97.3%, which corresponds to 108 arthrocentesis of the 111 performed. The average age of our operated patients was 41.62, with a minimum and maximum age of 16 and 76 years. The most frequent pathology operated was DDwoR (disc displacement without reduction), which affected 48 of the 111 operated patients, with a percentage of 43.6%. The second most frequent group were joint disorders (osteoarthritis, arthritis and degenerative joint pathology) with a 40% of all cases. Finally, patients with DDwR (disc displacement with reduction) were 16.4%.

The joint access was achieved in all patients with joint pathology when we use general anesthesia, although the number of patients (4 patients out of 111 arthrocentesis) was not enough to be able to perform an inferential study. On the other hand, the joint access in patients performed under local anesthesia and sedation was also high, 87.9% (94 of the 107 patients).

In patients who arthrocentesis was performed under local anesthesia and sedation (107 patients, 96.4%), if anesthetic induction was used before, the joint access and lavage were slightly higher, but with no statistical significance ($p = 0.33$).

As anesthetic agents used during sedation, midazolam was used in 84.1% of patients (90), and propofol in 54.2% (58 patients) of them.

When propofol was used, joint access and lavage was slightly higher but not statistically significant ($p = 0.11$).

And if midazolam was used, joint access and lavage was lower, although without statistical significance neither ($p = 0.65$).

Pain improvement

At one week postarthrocentesis, when propofol was used during sedation without midazolam, 100% (11/11 patients) improved in pain compared to 31/47 to propofol + midazolam ($p = 0.025$).

On the other hand, when only midazolam was used without propofol 30/43 patients (69.8%) improved in pain at one week postarthrocentesis compared to 31/47 (66%) to midazolam + propofol without statistical significance ($p = 0.332$). These results are shown in Table I.

At one month postarthrocentesis, the results in pain improvement were similar to those obtained at one week, in patients in whom propofol was used without midazolam, the improvement was 100% (11/11 patients) compared with to 34/47 to propofol+midazolam ($p = 0.055$). When only midazolam was used without propofol 35/43 patients (81.4%) improved in pain at one week postarthrocentesis compared to 34/47 (72.3%) to midazolam+propofol without statistical significance ($p = 0.822$). We can see these results in Table II.

Oral opening

Regarding oral opening there were not significant differences. In patients using propofol without midazolam, there were not significant differences at one week. The improvement was 81.8% (9/11) compared with 68.1% (32/47) in the group of propofol+midazolam ($p = 0.30$). When only midazolam was used, 60.5% (26/43) improved compared to 68.1% (32/47) in midazolam+propofol ($p = 0.512$). These results are shown in Table III.

Table I. Relationship between pain improvement and the use of propofol with or without midazolam and the use of midazolam with or without propofol during sedation at one week postarthrocentesis.

Propofol use	Midazolam use	Pain improvement one week		Total	P
		Yes	No		
Yes	Yes	31 (66%)	16(34%)	47 (100%)	0.025
	No	11(100%)	0	11 (100%)	
	Total	42 (72.4%)	16(27.6%)	58 (100%)	
Midazolam use	Propofol use	Pain improvement one week		Total	P
		Yes	No		
Yes	Yes	31 (66%)	16 (34%)	47 (100%)	0.822
	No	30(69.8%)	13 (30.2%)	43 (100%)	
	Total	61 (67.8%)	29 (32.2%)	90 (100%)	

Table II. Relationship between pain improvement and the use of propofol with or without midazolam and the use of midazolam with or without propofol during sedation at one month postarthrocentesis.

Propofol use	Midazolam use	Pain improvement one month		Total	*P*
		Yes	No		
Yes	Yes	34 (72.3%)	13 (27.7%)	47 (100%)	0.055
	No	11 (100%)	0	11 (100%)	
	Total	45 (77.6%)	13 (22.4%)	58 (100%)	
Midazolam use	Propofol use	Pain improvement one month		Total	*P*
		Yes	No		
Yes	Yes	34 (72.3%)	13(27.7%)	47 (100%)	0.332
	No	35 (81.4%)	8(18.6%)	43 (100%)	
	Total	69 (76.7%)	21(23.3%)	90 (100%)	

Table III. Relationship between improvement in oral opening and the use of propofol with or without midazolam and the use of midazolam with or without propofol during sedation at one week postarthrocentesis.

Propofol use	Midazolam use	Oral opening improvement one week		Total	*P*
		Yes	No		
Yes	Yes	32 (68.1%)	15 (31.9%)	47 (100%)	0.30
	No	9 (81.8%)	2 (18.2%)	11 (100%)	
	Total	41 (70.7%)	17 (29.3%)	58 (100%)	
Midazolma use	Propofol use	Oral opening improvement one week		Total	*P*
		Yes	No		
Yes	Yes	32 (68.1%)	15 (31.9%)	47 (100%)	0.512
	No	26 (60.5%)	17 (39.5%)	43 (100%)	
	Total	58 (64.4%)	32 (35.6%)	90 (100%)	

At one month ($p = 0.59$) postarthrocentesis, when propofol was used without midazolam the improvement was 81.8% (9/11) compared with 74.5% (35/47) to propofol + midazolam ($p = 0.47$). The same happened when midazolam was used without propofol: the improvement was 65.1% (28/43) compared to 74.5% (35/47) to midazolam+propofol ($p = 0.365$). The results are shown in Table IV.

Discussion

According to Mehra *et al.* [9], Fridich *et al.* [11], and Tuz *et al.* [12], results are superior when arthrocentesis is performed under general anesthesia, rather than under local anesthesia and sedation, being able to perform greater range of maneuvers and jaw movements in these cases, but without

Table IV. Relationship between oral opening improvement and the use of propofol with or without midazolam and the use of midazolam with or without propofol during sedation at one month postarthrocentesis.

Propofol use	Midazolam use	Oral opening improvement one month		Total	*P*
		Yes	No		
Yes	Yes	35 (74.5%)	12 (25.5%)	47 (100%)	0.47
	No	9 (81.8%)	2 (18.2%)	11 (100%)	
	Total	44 (75.9%)	14 (24.1%)	58 (100%)	
Midazolam use	Propofol use	Oral opening improvement one month		Total	*P*
		Yes	No		
Yes	Yes	35 (74.5 %)	12 (25.5%)	47 (100%)	0.365
	No	28 (65.1%)	15 (34.9%)	43 (100%)	
	Total	63 (70%)	27 (30%)	90 (100%)	

statistical significance. In our study, arthrocentesis was usually performed under local anesthesia and sedation. Only four arthrocentesis were performed under general anesthesia.

Due to arthrocentesis is usually performed under sedation there was not any control group in our study and this is another lack of information.

An additional bias is facial and cervical muscular pathology added to joint pathology. Both are frequently related and sometimes are very difficult to distinguish. Moreover, the perception of pain is a subjective parameter and it depends on many psychological and individual factors. This could influence in the results of pain.

The patients were not randomized in the 3 groups of different sedation. Although the drug choice used in each patient was aleatory and the evaluators were blinded in order to collect the results in pain and oral opening with the different type of sedation. Compared to patients receiving propofol and midazolam, all patients who received only propofol referred less pain at one week and one month postarthrocentesis. This difference was statistically significant at one week although it was not significant at one month. Albeit, the number of patients who received only propofol was 11 in contrast to 47 who received propofol plus midazolam. This difference in the number of patients may affect the final results.

In the study by Matsura *et al.* [13] about the muscle strength during sedation, using midazolam reduces muscle tone through the central receptors of benzodiazepines. However, in the peripheral receptors of facial musculature, it suppresses the nociceptive effect that inhibits the masticatory muscles which are contracted during jaw closure, which has a negative effect by increasing biting force. This increase in biting force could worsen the pain and the oral opening. Regarding the use of both, midazolam together with propofol, the last one inhibits the opening reflex of masticatory muscle when used at high doses by blocking the ES (exteroceptive suppression) 1 and 2 receptors which carry the mouth opening reflexes. This would increase the biting force while midazolam would be responsible for maintaining this force-enhancing effect through the peripheral nociceptive receptors of benzodiazepines as we have explained before. Therefore, the combined use of both, propofol and midazolam would be even worse.

Conclusion

The effect of propofol without midazolam may be better due to the action of midazolam in peripheral receptors of facial musculature which would increase biting force. However, in our study only 11 patients were treated exclusively with propofol in contrast to 47 who received propofol plus midazolam. More patients are needed to conclude that propofol is better than the use of other drugs. There are not enough studies on the use of anesthetic drugs and the achievement of joint access and how both factors could act in facial masticatory musculature during sedation. Therefore, more studies are needed to demonstrate whether the drugs used and their doses could influence the outcome of arthrocentesis.

Conflicts of interests: The authors declare that they have no conflicts of interest in relation to this article.

Funding

This research did not receive any specific funding.

Ethical Approval

Ethical approval was not required.

Informed Consent

This article does not contain any studies involving human subjects.

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