Arthroscopic Eminoplasty of TMJ. Surgical Technique

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Abstract
TMJ is one of the most used joint of the body. Moreover, it is common knowledge that TMJ may show degenerative changes 10 years earlier than other joints. Recently, the use of arthroscopic surgery is revolutionizing the classic management of TMJ pathologies. In fact, the minimal invasiveness of this procedure allows faster results and fewer complications than others procedures. In this paper, we would like to present our arthroscopic technique. In this line, we would like to emphasize that we used this approach in different TMD such as anchored disk syndrome, habitual dislocation of TMJ and internal derangement. Furthermore, we wish to underline that our efforts have been rewarded with great results.

Keywords: Habitual dislocation of TMJ; Anchored disk syndrome; Arthroscopic eminoplasty; Joint stability; Joint overload

1. Introduction
The treatment of TMD has always been a major challenge to the Maxillofacial Surgeons [1]. Although nonsurgical approach is frequently the first choice, it often fails in patients with chronic pathology [2]. Thus, numerous types of surgical procedures have been studied with the aim of reducing the symptoms caused by TMD [2]. In this light, most of these surgical techniques are based on an open approach. Nevertheless, the positive results achieved by arthroscopic techniques is changing the management of several TMJ pathologies. In fact, the minimal invasiveness
of arthroscopic procedures associated with a faster postoperative recovery time contribute to the wide dissemination of this approach [3]. Specifically, Sato et al. showed that arthroscopic eminoplasty is useful for treating TMJ habitual dislocation [2, 4]. Against this backdrop, we would present the technique that we use to carry out the arthroscopic eminoplasty of TMJ. We highlight that our method is based on Segami technique. Notwithstanding, we introduced certain modifications of this surgical procedure and we extended its use for treating different TMD. In addition, we underline that we perform this technique in more than 70 joints. Specifically, we carried out only this procedure in 18 cases. Whereas, in the remainder cases we associated the TMJ eminoplasty with other arthroscopic techniques such as myotomy and discopexy.

2. Surgical Technique

All surgeries were performed under general anesthesia and nasotracheal intubation. An arthroscope, 2.2 mm and 30 degrees, produced by Dyonics (Smith & Nephew) has been used to carry out the eminoplasty of TMJ.

Surgery begins with the introduction of a 23 gauge needle in the superior joint space. Subsequently, saline solution is introduced into the joint cavity in order to distend the articular space. Furthermore, the aspiration of synovial fluid confirms that the gauge is correctly located into the TMJ space. At this point, the introduction of a cannula into the posterior joint space is possible due to this expansion. Notably, is important to highlight that this cannula is approximately inserted 10mm in front of the tragus through a pointed trocar. Moreover, an Abbocath®-T 14 is inserted into the joint space with the aim to facilitate the joint washing and for enhancing the visualisation of the surgical field. Once in the joint, a meticulous analysis of TMJ anatomy is mandatory. In this light, the presence of a characteristic bulge facilitates the identification of the articular eminence. Besides, condromalacias areas are frequently observables in III, IV and V Wilkes stage. Afterwards, with triangulation technique a second cannula is placed at 25-30 mm from the first cannula (Figure 1) [5]. Finally, the surgical instrumentation is introduced into the articular space. Interestingly, through this cannula a surgical debridement of condromalacias areas of TMJ apex and eminence is carried out. This debridement could be performed with surgical files or with surgical drills (2.0 Full Radius Mini Blade, Smith&Nephew). With the condromalacias areas removed, we replace the previous instruments with an arthroscopic mill (2.9 Abrader Mini Blade, Smith&Nephew). This is an important step. In fact, with this surgical mill we perform the eminoplasty of TMJ apex. Importantly, we would like to stress that we draw an identification mark at a depth of 2 mm (in the center of eminence and in proximity to TMJ apex) before beginning surgery. This marking serves as anatomic reference to guide the milling of TMJ eminence. Specifically, we perform the eminoplasty with mediolateral direction. Thus, the central part and the lateral zone of TMJ eminence are the most interested by surgery. In light of the above, we would to stress that the surgical milling of TMJ emince is typically more aggressive in its lateral zone (4-5 mm). In fact, the remodeling of the medial zone should be more conservative (2-3 mm).

In this context, we underline that the surgical aggressiveness depends on the specific TMD and anatomical characteristics of each joint. Especially, we perform a more aggressive eminence remodeling for treating habitual dislocation of TMJ. In contrast, the eminoplasty is more conservative in the event of pathologies affecting the joint disc. Moreover, we stress that is imperative to respect the medial and lateral wall of the eminence. The main reason for this is to try to limiting external or internal displacement of mandibular condyle with the aim to improve the joint

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stability. In addition, it is mandatory to avoid surgical trauma of the glenoid fossa. In this line, it is important to underline that the visualization of a softer bone suggests that we are approaching the anatomical limits of the middle cranial fossa. Thus, in this context, the arthroscopic milling of the medial zone should be stopped. Indeed, iatrogenic lesions of this anatomical area could provoke an intracranial drilling. In this regard, Undt also affirms that special care has to be taken during the surgical manipulation of the TMJ medial zone [6]. Furthermore, the arthroscopic milling should also be avoided in the upper posterolateral portion of the eminence. The reasoning behind this statement is that surgical trauma of this area could provoke postoperative occlusal disorders. Finally, the surgical mill is removed from the anterolateral via. Instead, a synovectomy rongeur is inserted in the joint space. In fact, we also carry out a partial synovectomy of the synovial tissues presenting severe inflammatory signs. Importantly, we are quite conservative during the synovectomy. In fact, we want to prevent postoperative complications such as iatrogenic disc perforations. Moreover, before completing surgery, we remove the residues of TMJ fibrocartilage using arthroscopic files or arthroscopic forceps. Finally, a subsynovial infiltration (with dexamethasone and bupivacaine) in the posterior joint space is carried out. After the surgery is finished, a dressing is applied.

![Figure 1: Triangulation technique used for approaching TMJ space.](image)

### 3. Discussion

The main goal of this paper is to describe the technique that we use to perform the arthroscopic eminoplasty of TMJ. Furthermore, we want to point out that the choice of using this approach is based on some biomechanical characteristics of TMJ. In fact, we firmly believe that arthroscopic eminoplasty might improve not only the symptoms caused by some TMD but also the joint stability. Moreover, we are deeply convinced that this surgical technique could reduce the joint overload as evidenced by the following formula:

\[
W = \sigma \cdot A \cdot (a/h) \cdot \Delta D
\]

where: \(\sigma\) represent the average stress, \(A\) represent the average area of the stress-field (\(\text{mm}^2\)), \(a\) represent the average radius of the stress-field (\(\text{mm}\)), \(h\) represent the average minimum condyle-fossa distance (\(\text{mm}\)), and \(\Delta D\) represent the average mediolateral translation of the stressfield (\(\text{mm}\)) [7].
Specifically, h represent the mean condyle-fossa distance (mm). In this line, we want to show (with graphic evidence) that our technique is able to modify this specific parameter (Figure 2 and 3). In fact, the analysis of this formula shows that a decrease of h might reduce the joint overload. In addition, the integrity of the TMJ capsule-ligament system is respected with this approach. This is a very important assertion in terms of joint stability. Another key benefit of arthroscopic eminoplasty is the minimal postoperative morbidity. In fact, Sato et al. reported that arthroscopic eminoplasty guarantees postsurgical recovery times faster than open surgery. Specifically, in our patients the average hospital stay was 1 days.

Moreover, several authors reported the positive results that arthroscopic procedures provides in terms of TMJ pain and mouth opening [4]. In consideration of all the above mentioned, we strongly believe that arthroscopic eminoplasty should be considered as the treatment of choice for several TMD. This is especially true when the TMJ disk or the articular eminence are actively involved in the pathology. Thus, although numerous papers showed successful outcomes with open surgery [8, 9], we believe that the open approach should be reserved to cases where arthroscopic approach failed.

Figure 2: Schematic representation of arthroscopic eminoplasty.
With this ideas in mind we extended the use of arthroscopic eminoplasty for treating some TMD such as anchored disk syndrome, TMJ habitual dislocation and internal derangement. Interestingly, we would like to stress that this procedure showed brilliant results in our patients. Concluding, we emphasize that this report contains three points that are central to us: firstly, arthroscopic eminoplasty could reduce the joint overload and the stress acting on TMJ disc. Secondly, this procedure allows to maintain joint stability. In fact, it is able to increase the joint amplitude without detach the capsule-ligament system of the joint (Figure 4). Finally, we want to point out that this technique is characterized by extremely low levels of postoperative morbidity. Despite all that has been previously discussed we want to stress that the realization of an arthroscopic procedure is not a simple task. In many cases the learning-curve is long. However, this large learning period rather than be considered as an obstacle must be understood as a challenge for all maxillofacial surgeons. Only in this way we will achieve a change in the diffusion of arthroscopic procedures.

Figure 4: Arthroscopic vision of TMJ space. This image shows TMJ disc and eminence.

4. Conflict of Interests
The authors declare that they have no conflict of interests.

5. Ethical Standards
Authors declare we that they have taken into account the ethical responsibilities.

6. Authors’ Contributions
All authors participated in the creation of manuscript.

7. Financial Assistance
Authors not received financial assistance.

8. Informed Consent
References


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