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Arthroscopic osteoplasty of the medial and anteromedial wall of temporomandibular joint: surgical technique and anatomical considerations

Irene García Martín [a], Paolo Cariati [b,*], Angel Martínez-Sauquillo Rico [c], Almudena Cabello Serrano [c], Blas García Medina [c]

[a] *Department of Oral and Maxillofacial Surgery, University of Freiburg, Faculty of Medicine, Freiburg, Germany*
[b] *Hospital General Universitario de Albacete, Departamento de Cirugía Oral y Maxilofacial, Albacete, Spain*
[c] *Hospital Universitario Virgen de las Nieves de Granada, Departamento de Cirugía Oral y Maxilofacial, Granada, Spain*

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Abstract

The anterior displacement of the articular disc is the most frequent cause of pathological alterations in the TMJ. Although it is an extremely common pathology, there is no certainty about the aetiopathogenesis of this disease. The main aim of the present report is to describe new anatomical findings that could help clarifying the aetiopathogenesis of this disease and determine a typology of treatment based on the cause of the disease. All the operative records of patients who underwent arthroscopic osteoplasty of the medial TMJ wall in our centre from January 2021 to September 2021 were reviewed and analysed to identify specific anatomical features observed in every procedure. Fifty-two joints were included for analysis in this study. Twenty-two joints were classified as Wilkes stages II-III and 30 as Wilkes stages IV-V. The most common complication observed in our sample was the dysaesthesias found in the temporal and preauricular regions. Other complications observed were frontal branch paresis (n = 2), intraoperative bleeding (n = 1), and postoperative malocclusion (n = 1). The compression of the superior head of pterygoid lateral muscle (SPLM) on the medial bony wall and the consequent muscle atrophy could be key for the aetiology of the anterior TMJ disc displacement. Therapeutic actions on the osseous and muscular component in this anatomical area could improve the outcomes of patients affected by TMJ internal derangement. A meticulous dissection of the fascia of the superior fascicle of the lateral pterygoid muscle allows a remodelling of the bone surfaces with minimal complications

Keywords: MJ pathologies; TMJ internal derangement; TMJ arthroscopy; TMJ anatomy

Introduction

The anterior displacement of the articular disc is the most common cause of pathological alterations in the TMJ.[1,2] In most cases, this displacement is usually asymptomatic or causes only mild discomfort to the patients. However, in some cases it causes pain in the jaw and locks it open or closed, which are the most frequent causes of patient complaints.[1,2]

The causes of this anatomical alteration are unknown. It is usually observed in young people, without being associated with pathology in other joints. Hence, many factors have been proposed for the aetiology of disc displacement. However, none of them have been confirmed as the main cause of this disease.[2,3] It seems clear that anterior TMJ disc displacement does not represent a congenital disorder. In fact, it is now generally accepted to be an acquired degenerative process.[3,4] This situation is not exclusive of this joint. Other joints in young people present alterations that cause pain and/or functional limitation in the absence of associated systemic rheumatic symptoms. It has been hypothesised that repetitive trauma may be at the origin of these alterations

* Corresponding author at: Hospital General Universitario de Albacete, Servicio de Cirugía Oral y Maxilofacial, Calle Hermanos Falcos num 37, 002006 Albacete, Spain.
E-mail address: paolocariati1@gmail.com (P. Cariati).

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and, therefore, numerous surgical techniques try to act on this mechanism.[5–8]

Possible alterations of the lateral pterygoid muscle have been proposed as one of the factors involved in anterior TMJ disc displacement. Anatomical studies have determined that the fibres of superior lateral pterygoid muscle (SPLM) are clearly differentiated entering the inferior part of the articular disc in the anteromedial zone.[9] The SPLM arises from the upper third of the lateral pterygoid plate, from the infratemporal surface of the greater wing of the sphenoid, medial to the infratemporal crest, lateral to foramen ovale, and foramen rotundum.[10] This arrangement of the muscle fibres of the SPLM acts as a hammock to keep the articular disc stable over the articular eminence. Thus, it has been hypothesised that the hypotonia of this fascicle (and not hypertonia) might be involved in the displacement of the TMJ disc.[10]

In this sense, atrophy of the SPLM has been identified in various studies as the possible cause of disc displacement. Specifically, increases in signal intensity in the SPLM have shown a strong relationship with pathological alterations in the condyle and articular disc. This increase in signal intensity seems to be related to muscle oedema, fat atrophy, or both.[11] Similar results have been obtained by Taskaya et al.[12] In fact, these authors also demonstrated that an MRI signal increase of the SPLM was often related to anterior TMJ disc displacement.[12] Recently Cabuk et al found that intensity signal changes are correlated with the degree of disc displacement[13] (Fig. 1). These alterations usually affect the SPLM. However, the inferior head of lateral pterygoid muscle (ILPM) was also found affected in some studies.[14]

We hypothesised that the muscle atrophy could be related with repeated trauma of the muscle against the bony surface of the medial wall[15] (Fig. 2).

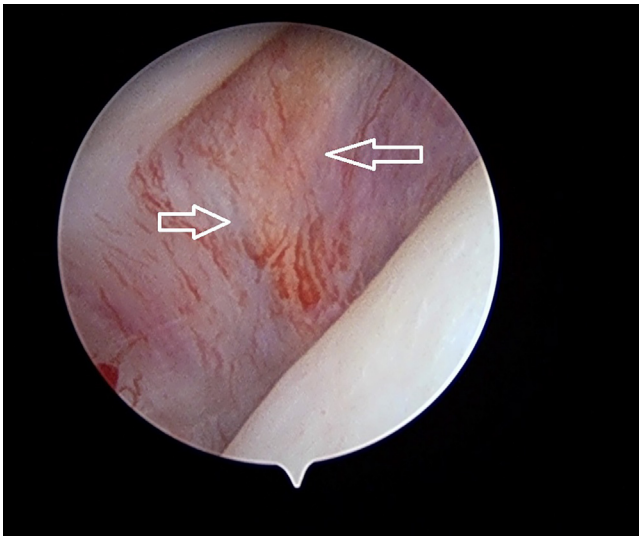

Fig. 1. Areas of fatty degeneration secondary to muscle atrophy affecting the fascia of the superior lateral pterygoid muscle in the medial wall of temporomandibular joint (White arrows).

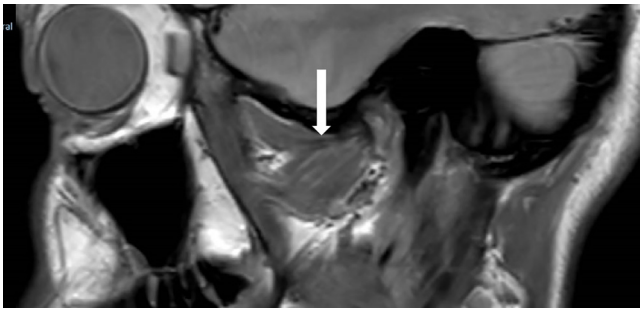

Fig. 2. Signs of repeated trauma of superior lateral pterygoid muscle in proximity of the bony surface of the medial wall that might contributed to the atrophy of the superior lateral pterygoid muscle and the consequent instability of the articular disc.

Material and methods

All the operative records of patients who underwent arthroscopic osteoplasty of the medial TMJ wall in our centre from January 2021 to September 2021 were reviewed and analysed to identify specific anatomical features observed in every procedure. The lead surgeon filled out the surgical history after each intervention and described the anatomical findings for each patient. The video of the entire procedure was also analysed and compared with the anatomical description found in the operative record of each patient. Complications related to the procedure were also analysed and registered. Descriptive statistical analysis was performed with IBM SPSS 23 to quantify the number and type of complications, Wilkes stage, number of treated joints, and the rate of visualisation of new anatomical findings.

Results

From January 2021 to September 2021, 67 joints were treated with arthroscopic osteoplasty of the medial TMJ and myotomy of the superior fascicle of the lateral pterygoid in our department. Patients with previous surgeries (arthrocentesis, arthroscopies, open surgeries), TMJ tumours, or habitual dislocation were excluded. Thus, 52 joints were included in this study. Twenty-two joints were classified as Wilkes stage II-III and 30 as Wilkes stages IV-V. The most frequent postoperative complication was the presence of dysaesthesias in the temporal and preauricular regions, which was observed in seven patients. Importantly, this complication resolved spontaneously in all patients during follow-up. Two patients showed frontal branch paresis that spontaneously recovered two and four months after surgery, respectively, while one patient showed an episode of intraoperative bleeding. One case of acute haemorrhage was also observed in our sample. One patient presented severe malocclusion seven months after surgery, which after a careful review of their clinical history, was diagnosed as idiopathic condylar resorption with no apparent relation to surgery. Importantly, a recess of 2–3 mm (measured with a joint feeler) depth between the anteromedial wall of the bone surface and the

superior fascicle of the lateral pterygoid muscle was observed in all cases.

Anatomical considerations

The medial wall of the glenoid fossa consists of the anterior-inferior aspect of the petrous portion of the temporal bone. The medial wall is obliquely separated from the tympanic bone of the temporal bone which forms the posterior wall of this joint.[16] Near this junction point, in the vicinity of the petrotympanic fissure are located the anterior tympanic artery and the chorda tympani[17–19] (Fig. 3). Thus, TMJ surgeons usually avoid approaching the posteromedial capsule of the joint to reduce the risk of damaging to this vessel and nerve.[20] In proximity to the medial wall, the lingual and inferior alveolar nerves can also be located at a variable distance between 3 and 7 mm.[20,21] The masseteric nerve and the deep posterior temporal nerve branches are mainly motor nerves with sensory components distributed to the anterior part of the TMJ capsule. The nerves leave the mandibular nerve approximately at the same level as the auriculotemporal nerve. The deep posterior temporal nerve branches follow the course of the masseteric nerve, but wind around the infratemporal crest to innervate the temporal muscle.[20] The masseteric nerve runs laterally, near to the anteromedial border of the lateral pterygoid muscle.[22]

Fibres of the lateral pterygoid muscle, with its fascia, completely cover the anteromedial wall and join with the synovium of the anterior recess. At the posteromedial level, the pterygoid fascia continues without solution of continuity with a loose tissue that corresponds in its upper part with the point of attachment to the medial with the posterior wall (Fig. 4).

On the other hand, various branches from the internal maxillary artery emit vascular branches from the tympanic, pterygoid and/or masseteric arteries to vascularise this region of the joint capsule.[22]

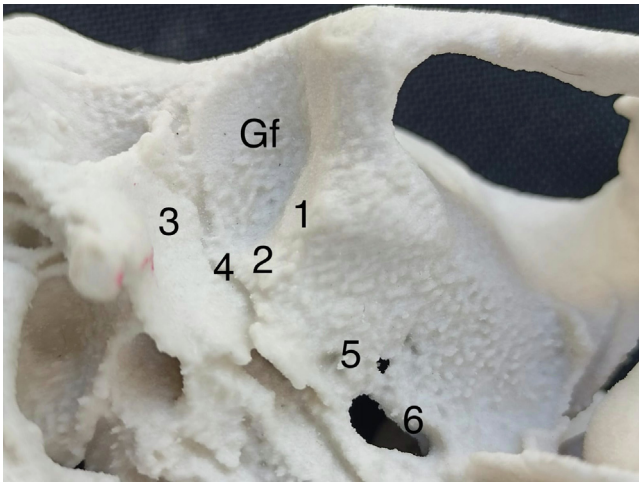

Fig. 3. Anatomy of the temporomandibular joint. Gf: glenoid fossa. 1-2. Anteromedial and medial bony wall. Between the two regions the lateral pterygoid muscle penetrates the joint. 3. Timpanic bone. 4. The petrotimpanic fissure located between the tympanic and petrous portion of temporal bone. The anterior malleus ligament, anterior tympanic artery and chorda of tympani pass through this fissure. 5. Foramen ovale. 6. Foramen rotundum.

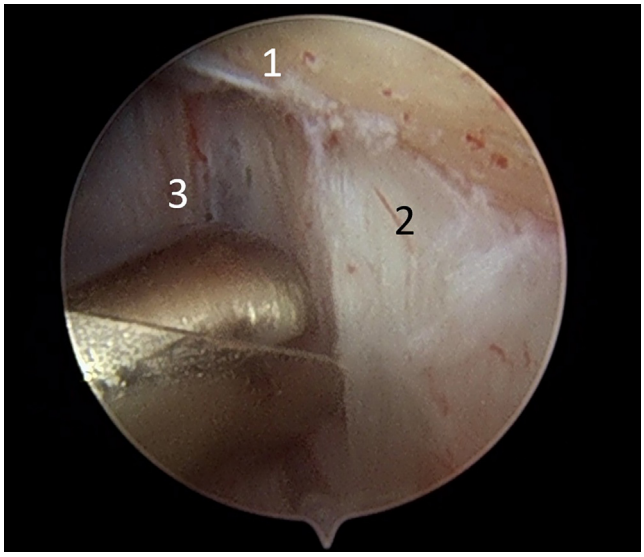

Fig. 4. Transition zone from the medial bone wall to the posterior bone wall. 1. superior lateral pterygoid muscle. 2. anterior-inferior aspect of the petrous portion of the temporal bone. 3. fibrous tissue that separates medial wall from the posterior wall.

Of special surgical importance is the distribution of the fascia of the lateral pterygoid muscle in the anteromedial and medial wall of this joint. This fascia descends accompanying the superior fascicle of the pterygoid muscle and slides from its origin through the internal bony wall of the petrous portion of the temporal bone. At some point during its descent, this fascia bifurcates into a double fibrous lamina (Fig. 5). Interestingly, the most external lamina is inserted into the medial bone wall to join the fibrocartilage articular. This external lamina can be meticulously dissected by using a coblator from its insertion in the bone wall, keeping the internal lamina fully integrated. In this way we can expose the entire bony surface of the medial wall and perform its osteoplasty without the risk of damaging nerve or vascular structures.

We have not found any work that describe this double fascia of the superior fascicle of the lateral pterygoid muscle.

Surgical technique

Step 1. Anterolateral approach to the upper joint space according to the technique described by McCain. Identification of the TMJ medial wall, which is deep in relation to the articular eminence. Through the fascia of the SPLM, areas of fatty degeneration are often identified (Fig. 1).

Step 2. With a triangulation technique, a Coblator II surgery system releases the superficial fascia of the SPLM which is attached to the articular fibrocartilage of the osseous surface of the medial wall. It is very important to keep the deep muscle fascia intact to avoid damaging the anatomical structures of this region (Video 1, online only).

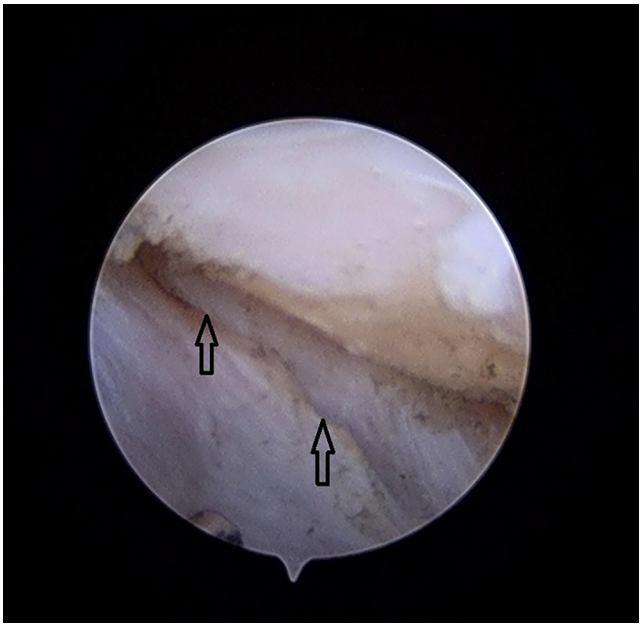

Fig. 5. Release of the external fascia of the superior lateral pterygoid muscle from its insertion on the medial wall of the petrous bone. Preservation of the deep fascia of the muscle protects against vascular and nervous accidents in this area.

Step 3. The anterior cannula is removed, and a 2.9 mm spherical drill is introduced through a CUDA cannula (Conmed) to perform the antero-medial and medial wall osteoplasty to remove 2–3 mm of the medial wall (Video 2, online only).

Discussion

The complex movement carried out by the temporomandibular joint to perform its function, requires an articular disc that moves anteriorly with the bony surface.[1,10,20] In addition, this movement needs an asynchronous displacement between the osseous surface of the condyle and the articular disc. In fact, the anterior movement of the disc is slower with respect to the mandibular condyle.[1,10,20] This complex movement complicates the stability of disc replacement with the techniques described. In all joints of the human body there is an intimate relationship between the bony surfaces and the soft tissues related to the joint. In the absence of previous trauma, anatomical alterations in the relationships between these structures have been described in others joints as a triggering cause of degenerative processes especially in those observed in young people.[5–8] In these cases, acting on bone surfaces may be necessary. However, numerous studies have not been written, to our knowledge, that analyse the impact of these factors in the aetiology of TMJ pathologies.[19] Moreover, due to the difficulties to surgically approach the TMJ space, the presence of important structures in this area and, the unavailability of rotating material to act on such small bony surfaces no many arthroscopic operative approaches acting on the TMJ bone surfaces have been described.[23–27] For all these reasons, most of the more used TMJ arthroscopic techniques aim to act on soft tissues only to treat the articular disc displacement.

The only muscle directly related to this joint is the lateral pterygoid muscle, which penetrates inside the joint through the osseous surface of its medial wall. There is sufficient scientific evidence that makes us think that the aetiology of the displacement of the TMJ disc could be related to the repetitive trauma on the medial bone surface of the SPLM.[9–13] According to the last paper published by our group, the trauma of the superior head of the lateral pterygoid muscle on the medial wall of TMJ could lead to fat degeneration and/or atrophy of this muscle with the impossibility of maintaining the articular disc attached to the bony surface of the articular eminence[15] (Fig. 6).

It is the opinion of the authors that the purpose of the treatment of anterior disc displacement should be aimed to eliminate pain and open or closed lock to achieve an acceptable mouth opening, allow a correct functionality and prevent the progressive degeneration of the joint. In this regard, it is necessary to remove 2 or 3 mm of the bone surface that compromises the integrity of the SPLM. The muscle fibres in intimate relationship with this surface should be eliminated. It is necessary to be very conservative with the myotomy procedure, and no more than 1 mm in depth should be resected to avoid the definitive atrophy of this muscle and prevent injuries to nerve or vascular structures located in this region. Since the muscle fibres come down to converge from its origin to the final insertion, myotomy is performed in the highest position of the bony surface of the medial TMJ wall.[28]

It is necessary to clarify that this surgical technique requires experience in arthroscopic techniques (level III McCain skills). It is extremely important to keep in mind that maintaining the integrity of the deep fascia of the SPLM is the key point to avoid complications.

Fig. 6. In advanced stages, the superior lateral pterygoid muscle is atrophic, and the muscle fascia is fragile and deteriorated. It can sometimes break simply by touching it. (White arrows).

According to our data, we have not found significant complications after using this technique. Temporary sensory alterations in the preauricular and temporal region, probably due to the damage of the auriculotemporal nerve, have been the most frequent complaints in our patients. However, these findings have been similar to those described with the classic technique used to perform the arthroscopic myotomies of the lateral pterygoid muscle. Moreover, a case of lingual nerve anaesthesia was detected in a patient with Wilkes Stage V, that required release of multiple adhesions at the level of the anterior and medial TMJ wall. In this case, we think that the adherence of the lingual nerve to the medial wall could be the cause of this complication.

Due to the considerations made in this paper, we believe that the compression of the SPLM at the level of the medial TMJ wall and the consequent muscle atrophy could be the key in the aetiology of the anterior TMJ disc displacement. Hence, in our opinion, this anatomical area should be the target of the therapeutic actions that try to treat this pathology.

The anatomical aspect discussed in this paper explains that it is possible to act on this anatomical area with sufficient safety and open new scenarios in the aetiology and treatment of TMJ displacement.

However, this study presents some limitations. First, it is a retrospective study with a short-term follow up. Moreover, no postoperative radiological studies were performed to study the position of the disc after surgery. In this sense, we believe that the most important effect of TMJ surgery should be the reduction of patient symptoms more than the position of the disc after surgery. In this sense, our technique demonstrated acceptable results. Further studies are needed to verify the real effectiveness and impact of our technique.

Ethics statement/confirmation of patient permission

Ethics approval not needed. Patient permission obtained.

Conflict of interest

We have no conflicts of interest.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjoms.2022.11.008.

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