Endoscopically-assisted transoral approach for the treatment of subcondylar fractures of the mandible

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Abstract

Introduction: Treatment of subcondylar fractures of the mandible is one of the most controversial aspects in the field of maxillofacial traumatology. This controversy centers on the positive and negative aspects of open and closed approaches for the treatment of this kind of fractures. Open techniques lead to good reduction and osteosynthesis, but have a high risk of injury to the facial nerve and produce facial scars. Closed techniques (intermaxillary fixation) reduce all the above-mentioned risks but rarely produce correct anatomic reduction, and complications such as ankylosis, condylar necrosis and inhibition of mandibular growth, causing abnormal occlusion, may occur. Despite all the associated risks, closed techniques are currently the most popular treatment.

Objectives: To introduce the endoscopically-assisted transoral approach for the treatment of subcondylar fractures, presenting three cases treated in our department. A description of the technique has been included as well as the clinical and radiographic results obtained.

Material and Methods: The study is based in three patients with subcondylar fractures of the mandible who were treated by an endoscopically-assisted transoral approach. A description of the surgical technique is included. The results were assessed by postsurgical radiographic control (orthopantomography), maximum mouth opening, occlusion and pain.

Results: Three reductions of subcondylar fractures with transoral endoscopically-assisted approach were undertaken. The follow-up period was 6 months. Postsurgical radiographic control showed good reduction of the fracture in all three cases. None of the patients showed any sign of temporomandibular dysfunction after 6 months.

Conclusion: Endoscopic treatment by transoral approach combines the positive aspects of both conventional techniques: closed and open reduction; allowing anatomic reduction and a stable fixation leaving no visible facial scars and with a minimum risk of injury to the facial nerve.

Key words: *Endoscopically-assisted transoral approach, subcondylar fractures of the mandible, minimally invasive surgery.*

Introduction

Modern surgery attempts to minimize as much as possible the patient's somatic and psychological trauma. Minimally invasive surgery is a good way to achieve this objective; and is therefore of growing importance in nearly all surgical specialties. Maxillofacial surgery is not an exception and it employs minimally invasive surgical procedures for the treatment of temporomandibular joint diseases (arthroscopy of the TMJ) (1) and maxillofacial traumas. Within the field of maxillofacial traumas, the treatment by endoscopy of fractures of the mandible, of the orbitozygomatic area and of the frontal sinus have been described (2). Other applications of endoscopy are surgery of the salivary glands (sialoendoscopy) and surgery of the base of the skull (2,3).

Subcondylar fractures of the mandible are frequent, their treatment being one of the most controversial aspects in maxillofacial surgery. The existence of this controversy is based in the positive and negative aspects of open reduction (preauricular, retromandibular and submandibular approaches) and closed reduction (intermaxillary fixation) for these kind of fractures. Open and closed reduction have been the two kinds of treatment used to date (4-6). Closed reduction, by definition, cannot achieve an anatomic reduction of the fracture and therefore, the function of the temporomandibular joint (TMJ) and its postsurgical rehabilitation will depend on the adaptation of the TMJ to its new modified condylar morphology. Possible complications are shortening of the ascending mandibular branch, open bite, malocclusion, limited mouth opening, lateral mandibular deviation when opening the mouth, dislocation of the contralateral temporomandibular joint, condylar necrosis and ankylosis of the temporomandibular joint (4-9). Open reduction can achieve an anatomic reduction of the fracture as it can be directly visualized, but there is a relatively high risk of injury to the facial nerve and undesired facial scars are produced (4,9). Endoscopic treatment by transoral approach of subcondylar fractures of the mandible is a technique designed to combine the positive aspects of both conventional methods mentioned above (10,11).

The objective of this article is to describe the endoscopically-assisted reduction of the subcondylar mandibular fractures and to show the clinical and radiographic results through the presentation of three cases treated in our department.

Clinical Cases

This study includes three patients with subcondylar fractures of the mandible who were treated by endoscopically-assisted reduction and fixation with titanium miniplates. In all three cases a transoral approach was used. The follow-up period was 6 months.

The type of fracture and the degree of displacement were assessed by orthopantomography before surgery. Fractures were classified according to the Krenkel classification (11, 12) considering high fractures those above the sigmoid notch and low fractures those below the sigmoid notch. The type of fracture, degree of displacement and result of the reduction were assessed intraoperatively with the endoscope. Postoperative control was accomplished by orthopantomography.

The surgical material for the reduction of the fracture included a 30-degree angulated and 4mm-thick optical retractor-dissector (Karl Storz®, Tuttlingen, Germany), a rhinoplasty aspirator-scraper, a transcutaneous device (straight drill for the opening of holes to place the screws and straight screwdriver), 1 mm-thick titanium miniplates with 4 holes and no bridge (Leibinger®) and 5-7 mm-long and 2 mm-thick screws (Leibinger®) .

After surgery, the function of the mandible and the temporomandibular joint were assessed by measuring maximum mouth opening, mandibular deviation when opening the mouth, correct lateral moving of the mandible, existence of malocclusion and pain in the temporomandibular joint.

Surgical technique: Surgery carried out under general anaesthesia and nasotracheal intubation. An intraoral incision over the oblique line, similar to Obwegeser's incision for sagittal mandibular osteotomy, was performed after infiltrating the area with local anaesthetic and vasoconstrictor (2-3, 2ml ampoules with 40mg of articaine and 0.0005 mg of epinephrine). The masseter muscle was then lifted in order to access the ascending mandibular branch.

The fracture reduction was performed with the optical retractor assisted with a rhinoplasty aspirator-scraper. Once the fracture was reduced, we proceed to perform the intermaxillary fixation with fixation screws and rubbers. Immediately after, miniplates were placed with long tweezers through the intraoral incision and were fixed with screws introduced through the transcutaneous access. Once the miniplate was placed, correct mouth opening and occlusion were checked and we then proceeded to close the incision with absorbable suture. The parasymphyseal fractures were treated by intraoral approach and fixation with two miniplates.

- *Clinical case 1:*

A 23 year-old man with no relevant medical history consulted the emergency service presenting mandibular trauma after having been assaulted. Physical examination showed a fracture line between the lower left first and second molars, with displacement and absence of occlusion of the dental arches. The radiographic study by orthopantomography showed a left parasymphyseal fracture and a low right subcondylar fracture. Surgery with endoscopically-assisted transoral approach was performed, carrying out reduction and osteosynthesis of both fractures. One miniplate was placed on the subcondylar fracture and two miniplates on the parasymphyseal. Intermaxillary fixation was maintained for 5 days postoperatively.

Fig. 1. Clinical case 2. Preoperative orthopantomography. Left high displaced subcondylar fracture.

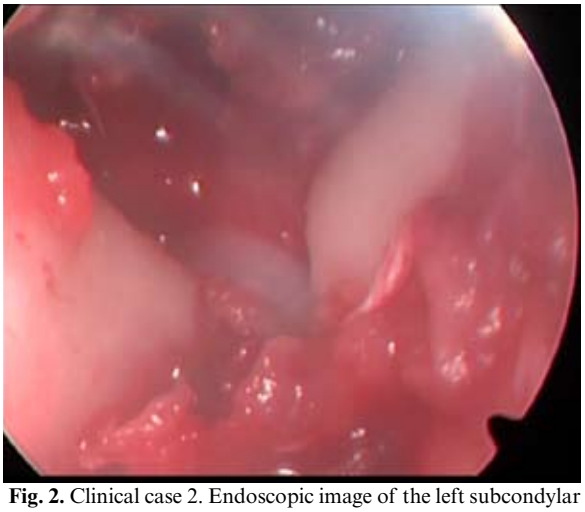

Fig. 2. Clinical case 2. Endoscopic image of the left subcondylar fracture, displaced and high.

Fig. 3. Clinical case 3. Preoperative orthopantomography. Right subcondylar fracture and left parasymphyseal fracture.

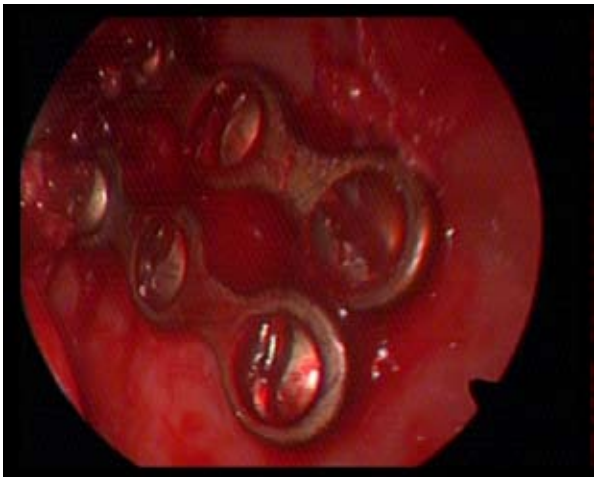

Fig. 4. Clinical case 3. Endoscopic image of the left subcondylar fracture, displaced and high.

Fig. 5. Clinical case 3. Orthopantomography two months after surgery.

- *Clinical case 2:*

A 15 year-old woman with no relevant medical history was admitted to hospital due to mandibular trauma. During physical examination, malocclusion and a right parasymphyseal fracture were observed. The radiographic study by orthopantomography confirmed the existence of a right parasymphyseal fracture and a left high subcondylar fracture. (Fig.1,2). Surgery with endoscopically-assisted transoral approach was performed, fixing the subcondylar fracture with a miniplate and the parasymphyseal fracture with two miniplates. Intermaxillary fixation was carried out and maintained for 10 days after surgery as it was an unstable, displaced and high fracture. Twenty days after surgery, the patient returned to our department with a subcondylar fracture on the other side, probably produced at the same time as the first but which did not become clear until a new mandibular trauma occurred. This second mandibular trauma was treated by intermaxillary fixation.

- *Clinical case 3:*

A 27 year-old man with no relevant medical history consulted the emergency service presenting mandibular trauma after having been assaulted. Physical examination showed a fracture of the mandible in the left parasymphyseal area with altered occlusion. The orthopantomography showed a left parasymphyseal fracture line and a right low subcondylar fracture (Fig. 3). Surgery with endoscopically-assisted transoral approach was performed, fixing both the right subcondylar fracture (Fig. 4) and the parasymphyseal fracture with two miniplates. Intermaxillary fixation after surgery was not performed.

Osteosynthesis of all subcondylar fractures was perfor-

med with endoscopically-assisted transoral approach. In all cases a good visualization of the fracture and a good intraoperative control of the reduction and osteosynthesis were achieved (Fig. 4).

The intraoperative time ranged from 1.5 to 5 hours. The latter being the case of the left high, displaced and unstable subcondylar fracture. All patients were discharged after 48 hours of surgery. Intermaxillary fixation was maintained postoperatively in two cases: in case 1, for 5 days and in case 2, for 10 days due to the unfavourable situation of the fracture (displaced, high and unstable).

Postoperative radiographic control was carried out by orthopantomography, which showed a correct anatomic reduction and restoration of the ascending branch height with no malocclusion in 2 out of the 3 cases (Fig. 5). In the case of the patient with left high subcondylar fracture, a perfect reduction could not be achieved. All 3 patients presented good mandible mobility immediately after surgery and were required to follow a soft diet for 30 days.

At the present time, after a follow-up period of 6 months, all three patients present good occlusion and a mouth opening of over 35 mm with no lateral deviation. Lateral movements do not present any limitation and there are no signs of temporomandibular joint dysfunction. So far, the evolution of the three cases is satisfactory.

Discusion

Endoscopically-assisted transoral approach treatment of subcondylar fractures of the mandible is included within the concept of minimally invasive surgical procedures. Within the field of maxillofacial surgery, arthroscopy of the temporomandibular joint is another example of minimally invasive surgery (1). Arthroscopy is less traumatic because it uses very small incisions and minimizes the damage that exposure to the open air and manipulation may produce in the inner tissue. The risks of complications related to the surgical wound such as bleeding, infection or dehiscence, are notably reduced (2).

Regarding subcondylar fractures of the mandible, this technique is becoming more popular, but is still far from being in general use. This technique combines the positive aspects of the open and close reduction (2, 5).

This treatment leaves no facial scars and the risk of injury to the facial nerve is minimum (2, 5). It provides a direct view of the fracture, thus allowing anatomic reduction and a sufficient stable fixation. Concerning fixation, it must be considered that miniplates provide a semi-rigid fixation, and when added to the fact that we are dealing with fractures of the mandibular condyle (where there are two directions of mandibular forces (13); then the optimal number of miniplates is two: one parallel to the condylar axis and the second parallel to the semilunar notch axis (12, 14). In our series of three patients, we only placed two miniplates in the last case (Fig. 4,5). The patient described in clinical case 1, was the first patient treated by this technique in our service. Due to our lack of experience and the technical difficulties derived from it, we only placed one miniplate. In the second case, the nature of the fracture: high localization, its degree of displacement and the consequential instability (Fig. 1,2) made it very difficult to place two miniplates. For this reason, in these first two cases, postoperative intermaxillary fixation was performed and maintained for 5 and 10 days respectively, as a security measure. The main limitations for this kind of treatment derive from the difficulty of the surgical technique itself: the need to invest in the equipment and in instruments; the learning process to master the endoscope presents a very slow learning curve. As a result, the time of surgery for the first operations is longer than that of a traditional closed or open reduction (3-5, 10).

Patients included in this study represent a very small group who were considered acceptable to undergoing surgery with this technique for the presentation of displaced symptomatic subcondylar fractures. Larger samples of patients can be found in the published literature (11): Lee et al. in 1998, studied 20 patients involving 22 subcondylar fractures; Chen et al. in 1999, studied a sample of 8 patients; Schön et al. in 2002 (4) who compared the transoral to the submandibular approach , both endoscopically-assisted, and concluded that the risk of involvement of the facial nerve and the time of surgery were higher in the submandibular approach; Schön et al. in 2003 (5), studied 8 patients with a follow-up period of 18 months; Kellman et al. in 2003 (14) studied a sample of 9 patients. All the above-mentioned studies produced very favourable results, both from the functional and aesthetic aspects.

The results obtained from our sample of patients are also very satisfactory: all patients present good mouth occlusion, a mouth opening over 35 mm and no signs of temporomandibular joint dysfunction after 6 months.

Endoscopically-assisted transoral approach is mainly indicated for subcondylar fractures with lateral displacement (4, 5), although it can also be used in fractures with medial displacement (5). However, this technique has still not been adopted as the routine technique due to its higher technical difficulty compared to extraoral approaches, which povide better visibility (4).

For non-displaced subcondylar fractures, where occlusion is not affected, and with good mandibular mobility and little pain, treatment by observation for 7 to 10 days or by intermaxillary fixation is preferred. Fractures of the condylar head and intracapsular fractures must be treated by intermaxillary fixation (11).

The use of angulated drills and screwdrivers facilitates the transoral management of these type of fractures, without needing to use a transbuccal instrument, (used in our patients) (4, 5).

The main difficulty in using and popularizing this technique is its learning curve and the availability of the specific surgical instruments required (15).

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