RSBO

ISSN:
Electronic version: 1984-5685
RSBO. 2017 Apr-Jun;14(2):106-13

Case Report Article

High mandibular ramus fracture – endoscopy treatment: a case report in adult

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Received for publication: February 2, 2017. Accepted for publication: March 13, 2017.

Keywords:
mandibular ramus; endoscopy; high fracture.

Abstract

Introduction: Fractures of the mandibular condylar region are very common, but treatment is controversial; the same fracture can be treatment by either conservative treatment or surgery. When surgery is chosen, the search for the best surgical access also has many doubts. The options for open surgical accesses are: pre-auricular, submandibular, and retromandibular. For intraoral access (similar to sagittal osteotomy of the ramus), the aid of endoscopy, an image equipment, enables the perpendicular visualization of the fracture. **Case report:** In this clinical case, the authors describe a high mandibular ramus fracture in which the intraoral approach was used associated with endoscopy for the reduction and fixation of the fracture. **Conclusion:** Success of the radiographic and clinical outcome could be observed by the anatomical reduction of the fracutre and the solution of the patient's requests.

Introduction

The fractures of the articular region are common and affect between 26%-40% of all mandibular fractures, according to data from literature. The major etiological cause is the car accidents (32%), followed by aggressions (28%), falls (26%), accidents during sports practices (10%), and pathological fractures (4%) [2, 4, 18].

The mandibular ramus has two thin bone corticals of compact bone and a thin central region of cancellous bone. The bone of the ramus bone is thinner than the bone of the mandibular body. The existence of a strong musculature in the ramus region does not enable that the bone fragments suffer major displacements, thus mostly the fragments are contained by the muscles, even in cases of comminuted fractures. Because the mandibular body does not have this lateral muscular insertion and most of the muscular insertions are medial, from the chin to the mandible's angle, the muscle does not contain the fracture, favoring larger movement of the bone fragments. The fractures limited to this region are rare (3% of mandibular fractures involves), because of the amount of soft tissue that protects the area. The fractures of the mandibular head are located below the mandibular notch, staying in the fragment above the head and mandibular coronoid process [15].

Likely to the mandibular ramus, the upmost structure - the head of the mandible is also a thin and fragile structure of the jaw. The shape and thickness of the neck prevent further damage to the other adjacent structures, as the base of skull fractures, dramatically reducing the spread of the force generated by the trauma. The position of the fractures of head of the mandible is not only related to the place and the severity of the trauma, but also to the position and action of the masticatory muscles and the presence or absence of teeth [3] .

Complications of fractures in the region next to the temporomandibular joint (TMJ) include: malocclusion, loss of posterior vertical height in the mandible resulting in face asymmetry, projection of the chin, loss of the sagittal plan, and loss of the TMJ function/mobility [2] .

Unfortunately, the choice of the type of treatment still is subject of debate [9] . The literature lacks consensus on the ideal treatment and management of the fractures of the condyle areas [1, 21] . Reviewing the literature, there are several drawbacks because in most studies have flaws in randomization and classification of the type of fracture. In addition, comparisons between the different surgical approaches are very rare and the number of patients per study is low [9].

The absolute indication for the surgical treatment of TMJ fractures are: (1) displacement to the cranial fossa; (2) inability to obtain proper occlusion with closed reduction; (3) lateral extracapsular displacement of the fragment, and (4) invasion of foreign body in the joint [22]. In relation to the surgical access, the retromandibular transparotid approach has significant advantages for accessing the subcondylar region and the high ramus fractures. In this approach, the fracture line is clearly observed.

However, the search for an esthetic solution for extraoral incisions has become increasingly necessary. In medicine, the advancement in this area began through the endoscopic surgery. The endoscope was introduced by plastic surgery in 1900 with the idea of showing the interior of the human body with lighted telescopes. In the beginning, IT was a RIGID apparatus, after 30 years the endoscope became semi-flexible and was used inside the stomach. Only in 1960, the optical fiber was developed and its use widespread. The first use in the face was held during a lifting of the front region without the need of coronal access. In 1995, researchers showed that the use of the endoscope could be made in the treatment of zygoma fractures, from that moment on they began to stimulate the endoscope use in face trauma [20].

The benefits of endoscopic visualization technique include: more esthetically incisions, smaller scars, better hemostasis, visual improvement of the surgery, and shorter postoperative recovery time [20].

Intracapsular fractures and high mandibular head fractures cannot be treated by the endoscopic method because of the inability to obtain the fixation of the bone stumps [16]. On the other hand, subcondylar fractures, similar to the high ramus fractures, can be treated with the aid of the endoscope if enough bone in the extracapsular portion is available to enable the adequate visualization of the reduction and placement of at least two screws on each side of the titanium miniplate. Lesser degrees of comminution, which only affect a portion of the fracture line can be management by the endoscopic technique [13] .

The training and use of endoscopes by experienced surgeons, under normal conditions and statistical relevant situations, satisfactorily and consistently solve the dilemma between the corrective procedures and the necessity of scars [7] .

This case report describes a high mandibular ramus fracture with treated with the aid of endoscopic visualization.

Clinical case

Patient M.K.L., 18 years-old, female, searched the maxillofacial trauma service at the Vitória Hospital (Curitiba-Paraná), for correction of mandibular fracture. At clinical examination, the patient showed a shift in mouth opening towards the right side, opening limitation, pain at manipulation, and mandibular occlusal step in the area between the teeth 33 and 34. At extraoral inspection, she had a small volume increase on the right hemiface, without tears or bruising. Biochemical blood tests without changes. The computed tomography (CT) image confirmed the presence of high mandibular ramus fracture on the right side associated with fracture of the parasymphisis on the left side (figure 1).

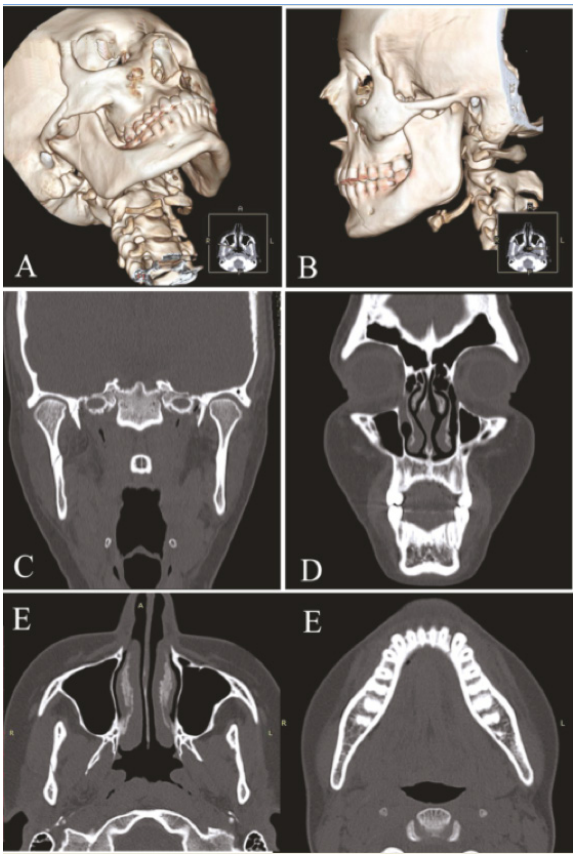

Figure 1 – CT scan images showing the high mandibular ramus fracture on the right side and the parasymphisis fracture on the left side

For the surgical reduction of the parasymphisis fracture, an intraoral access was proposed with incision in bottom of vestibule in fractured region for reduction and fixation with two plates system 2.0 Osteomed in parallel. At that point, we decided to use self-compressed plates to achieve axial compression of the stumps and consequently an anatomically reduced fracture. For fracture of the mandibular ramus, we planned an intraoral incision access similar to that for sagittal osteotomy of the ramus and endoscopic visualization (Karl Storz Endoscope® 1.9 mm). The endoscope was used to aid in the bone placement and fracture fixation. For this region, we used a plate with four screws System 2.0 (figure 2).

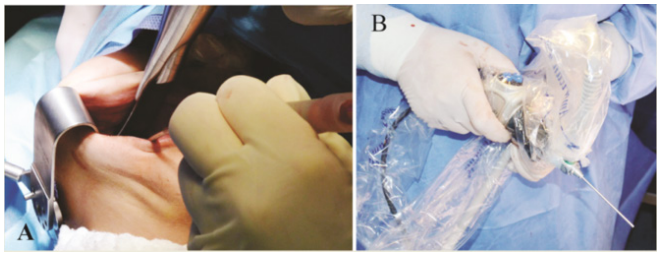

Figure 2 – (A) Installation of the trocar to allow better access of the endoscope to fractured region; (B) endoscope device used for fixation of the of high mandibular ramus fracture

During the surgical procedure, the intraoral access was carried out and then located the Bauer and Merrill-Lavasseur retractors positioned for exposing the fracture. During the procedure, the patient remained blocked by intermaxillary fixtures (IMF) so that she did not have occlusal changes (figure 3). The endoscope (angulation of zero degree of optics) was installed and intraorally placed through the orifice created by the trocar. Thereby, a perpendicular view of the fracture was obtained to aid in the fracture reduction. The images taken by the endoscope demonstrate the proper anatomical reduction of the fracture (figure 4).

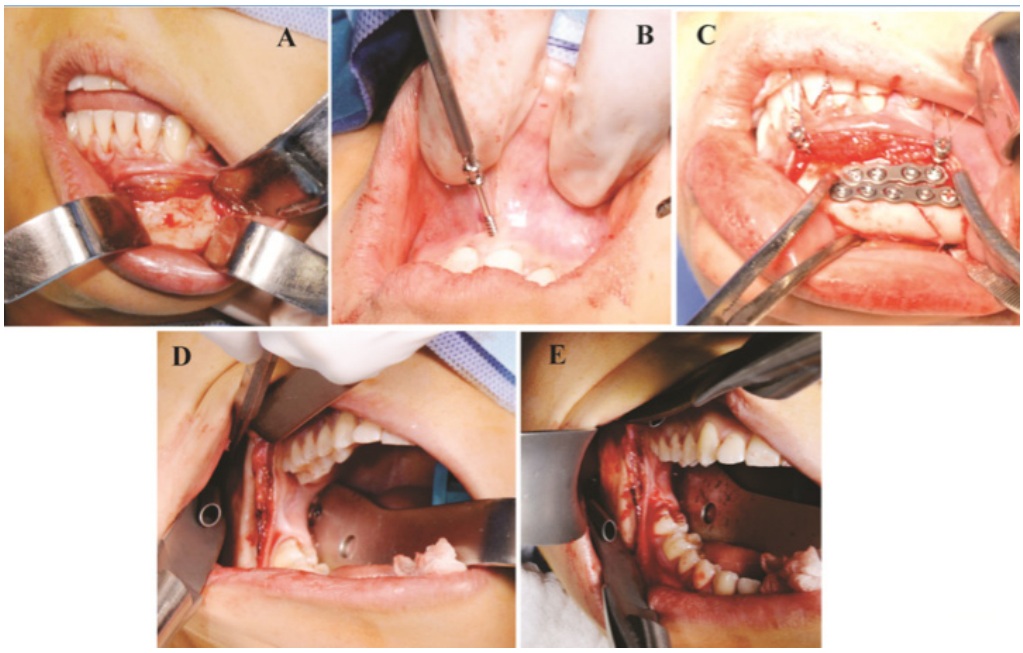

Figure 3 – (A) Intraoral access for fixation of the mandibular parasymphisis fracture; (B) maxillomandibular blockage using IMF screws and steel wire; (C) rigid internal fixation (RIF) of the parasymphisis fracture using two parallel plates system 2.0 with four holes and another with six holes; (D) intraoral access in the mandibular ramus, retraction with Bauer and Merrill-Lavasseur retractors; (E) front view of high mandibular ramus fracture

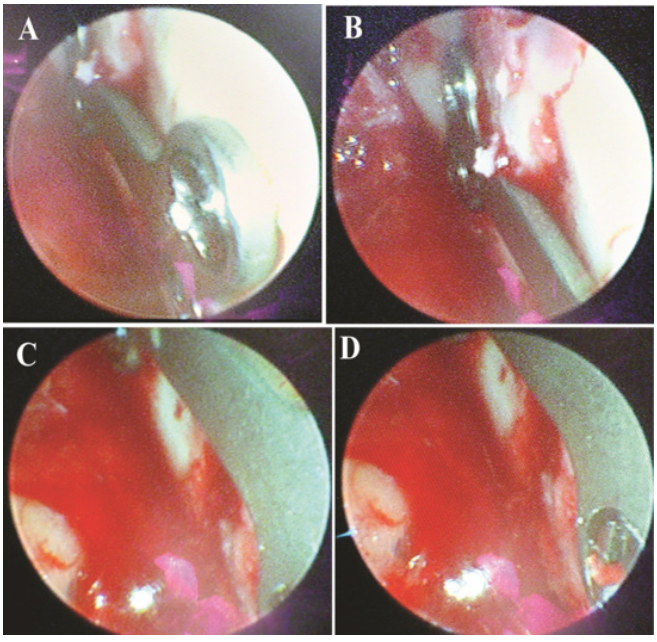

Figure 4 – Images captured by THE endoscope showing the result of the RIF

Discussion

In not displaced fractures of the mandible, head the conservative treatment through IMF is the most commonly used, even in non-collaborative patients that the treatment protocol was not possible. Good functional results in the follow-up of non-surgical cases were reported, but non-surgical cases need longer postoperative functional therapy. The functional therapy is indicated to improve the results of articular rehabilitation when the functional impairment is present [19].

The mandibular ramus is located between a dentate (angle/body) and non-dentate region (condyle and coronoid process) of the mandible. There are no clear indications and contraindications on the open or closed treatment of those fractures. The management of these fractures is still an enigma; however, certain aspects of the treatment keeps the possibility of clinical impressions and personal opinions. Because this type of fracture rarely causes occlusal disorder and because of the difficulty of access to fractured points, conventionally the

closed treatment is chosen. The decision by the open surgical procedure considers the presence of either simple or multiple fracture. The mandibular ramus fractures are rarely solitary and in most cases, are associated with other jaw fractures and/or fractures of the middle third of the face; if it eventually happens, surgical treatment becomes the choice [11].

Although the pre-auricular access is indicated for high mandible's head fractures, there are some negative aspects, such as in lower fractures and high ramus fractures. Such access does not allow the surgeon to work perpendicular to the fracture line, which limits the rigid fixation and makes the procedure more uncomfortable [17].

The pre-auricular, submandibular, intraoral, and retromandibular accesses are the most used to make rigid internal fixation of mandible's head fractures [21]. Because of the anatomy of the ramus that is wrapped by the masseter and medial pterygoid muscles and the pterygoid-masseter ligament, even after the fracture, the displacement of the stumps is minimal. Because of this, most surgeons opt for closed treatment. However, close reduction has certain limitations: the prolonged maxilomandibular fixation (MMF), the non-maintenance of oral hygiene, the risk of airway impairment, the non-compliance of the patient, deprivation of food, and delays in recovery [11].

Many surgeons prefer to treat these fractures by extraoral access rather than intraorally thanks to good visualization of the operatory field by traditional technique [21]. The submandibular approach offers a wide field of vision, but the length of the scar from the incision is the most important disadvantage. The preauricular approach is suitable for intracapsular fractures of TMJ; in cases of subcondylar fractures, the incision line must be extended on the lower portion of the ear to improve access. The retromandibular transparotid approach has significant advantages and offers the best cost-benefit results to access low fractures of mandibular head and high fractures of the ramus. The fracture line can be seen clearly and, if necessary, the incision can be easily extended through the pre-auricular region and marginal region of the mandible [1].

However, compared to intraoral access, the extraoral access are associated with a greater number of surgical complications, such as salivary fistula formation, visible scar, and injuries to the facial nerve, c. Thus, it is expected that there will be an increase in the popularity of minimally invasive surgery in the future [21].

The patient of this case report did not accept visible scars on her face considering her age and esthetic aspect. Another unacceptable aspect was staying with IMF after surgery, because of the discomfort to keep his mouth shut during the postoperative period. By looking at these issues, the fact that it is a case of associated mandible fractures, which is a clear indication of surgery, we evaluated performing intraoral incision associated with endoscopic visualization to obtain better results. The goals to be achieved with the treatment of the fracture were: absence of pain on opening the mouth, opening with an interincisal distance greater than 40 mm, good mandibular movement for all sides, re-establishment of pre-trauma occlusion, TMJ stabilization, and good symmetry of the face [16]. These treatment goals could only be achieved with a good visualization of fracture, either by endoscopy or by traditional view [10].

The endoscope results in a safer and more exact surgical procedure, even if in some cases it is necessary to use additional access to better view during the procedure. Usually bone fragments in the articular region are very difficult to see, in these cases the use of the endoscope associated with the intraoral access reduces the problems of surgical execution [5].

The indications for treatment of fractures that involve bone structures of TMJ by intraoral access are: medial inclination of the fragment greater than 15 degrees, shortening the greater ramus more than 5%, insufficient contact of the fragments, and fractures with little displacement with other fractures with indication of fixation under general anesthesia [14].

To ensure that occlusion would be stable, the IMF was performed only in the trans-operative period. The patient was previously informed that if it was not possible to access the fracture intraorally for fixation, a complementary extraoral access could be done, with the risks that this would damage the facial nerve. She was also informed that this decision would be taken during the surgery by the responsible team.

The proximity of the facial nerve to the TMJ compromise the access to fractured segments. Efforts to improve surgical access may result in direct damage to the facial nerve or a traction injury during retraction of the stumps. An open intraoral approach, designed to surpass these problems, has been reported, but is rarely used, because of poor viewing and difficult fixation. The use of endoscope to treat articular injuries was a natural extension of the minimally invasive management

of craniofacial traumas. The endoscopic approach has the potential to reduce surgical morbidity by reducing scars, reducing the risk of damage to the facial nerve, eliminating the need for IMF, embracing the advantages of promoting an anatomical reduction, and allowing rigid fixation [16]. However, the operator ability is still necessary to overcome the hardest steps of an endoscopic procedure: subcutaneous dissection, soft tissue hemorrhage management, and handling of specific instruments. The choice of any approach, whether extraoral or intraoral, may have different consequences, but that does not change the benefits of having a well-trained professional [8].

Facilitating the handling to reduce fractures as those with medial displacement with medial angle greater than 90 degrees and offering adequate space on both sides for rigid fixation for direct access to the site of the fracture can be disadvantages of endoscopic techniques. Despite the complex anatomy of the area, the technique helps to preserve the structures and reduce risks to the facial nerve [14].

A positive point of the use of the endoscope is the reduction of tissue injuries attributed to less bone exposure of the articular region [12]. This exposure that can lead to devascularization of the bone of the mandible's head and later complications.

The mandible's head fractures are indications for endoscopic treatment if the proximal bone remnant is enough to accept two screws for fixation of Miniplate [16]. For fixation of mandibular fractures, two miniplates seem to be more appropriate than just one during the repair.

In the treatment of injuries of the mandible's head, the endoscope not only helps the surgical execution but also changes the paradigm of treatment from RIF conservative treatment to anatomical reduction of fracture [16]. The problem is that the intraoral use of the endoscope needs extensive training of all members of the team and has higher cost [18]. The technique has some limitations: (a) fractures significantly comminutes are a contraindication for endoscopic repair, since it is based on viewing of the line of fracture for the anatomical reduction and some degree of contact between the fragments for rigid fixation [16]; (b) when the fracture is severe, uncomfortable and comminute or the facial reconstruction is large with need to perform intra and extraoral traditional accesses for greater exposure and visualization [20].

The risk for facial nerve palsy or other neurological complication occurs considerable often for RIF techniques through extraoral access is theoretically reduced using the technique [12].

The final occlusion and mandibular movements were evaluated immediately after the procedure and the result was satisfactory. It was found after the return of consciousness of the patient that the sensory aspect was preserved (Figure 5 and 6). Physiotherapy for opening the mouth began in the first postoperative day and soft diet kept. After 15 days of following-up, it was clinically observed good healing and radiologically good reduction of fracture without presence of edema or hematoma in the face. After two months of surgery, during the follow-up appointment the patient did not report any pain and edema was not observed and free diet was released.

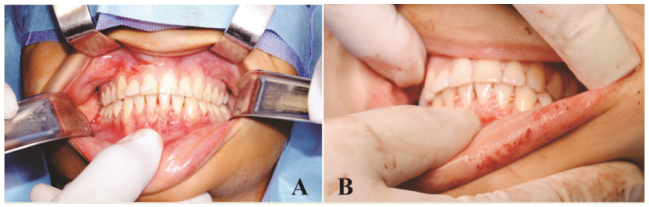

Figure 5 – (A) Intraoral aspect. Stable occlusion and the absence of soft tissue lacerations; (B) occlusal aspect after fixation

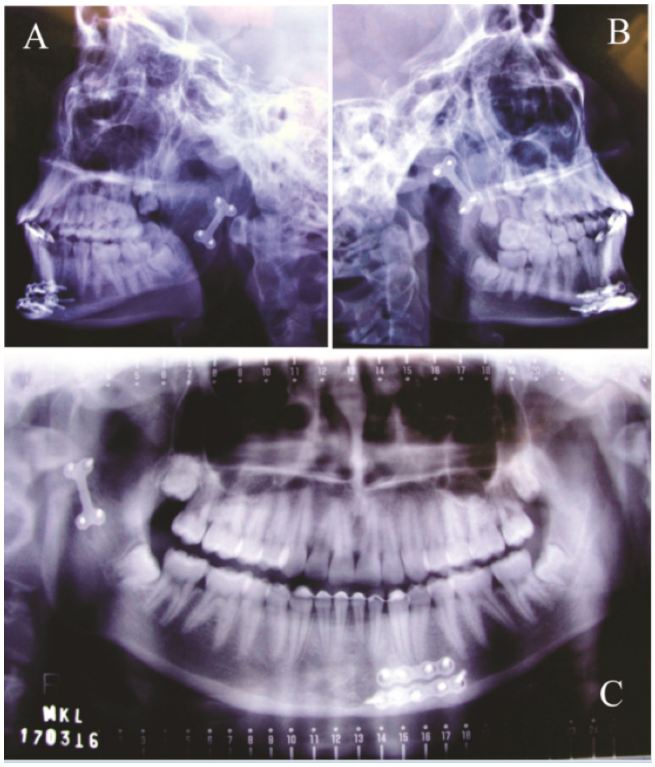

Figure 6 – Radiographic examinations assuring good reduction and fixation of fractures

The endoscopic-assisted surgery proves to need more time for implementation. Intensive training and use of specific retractors are mandatory for trans-oral execution of the mandible's head fractures. However, the endoscope, when well indicated, can offer advantages over traditional treatment. Reduced surgical time is described as an advantage of the RIF technique for extraoral access. Intraoral access, such as those used in the sagittal osteotomy of the mandibular ramus, has the time further reduced [6]. It is understood that, to facilitate the reduction of fractures and reduce time spent in surgery, minor surgical instruments must be developed [20].

In relation to the operative time, no difference was observed regarding using the endoscopic visualization. The use of the endoscope decreased the time spent with sutures, since we have reduced the amount of surgical access, a fact that may have compensated the time spent with the equipment assembly.

In 2004, a literature review compared a series of data between the traditional method of surgical approach (RIF) and the method with endoscopic visualization. Chronic pain was reported in 0-6% of cases treated traditionally, while in endoscopic technique no pain or TMJ dysfunction was reported. Maximum interincisal opening with endoscope was slightly greater (42-49 mm x 40-50 mm), as well as the movements of laterality (3.1 -12.6 mm x 3-9 mm), protrusion (8.9 -3.3 mm x -1.2 mm 6.7), and standard deviations of mouth opening (0.2-3.6 mm in the traditional method without deviation, or 37% with slight deviation in the endoscope-assisted treatment). In relation to the shape and symmetry of the face, the same studies report that the both the traditional and endoscope-assisted method reached the pre-traumatic anatomy or an anatomy with acceptable aesthetics without noticeable asymmetry. Considered the occlusal aspect, the traditional treatment returned the original function at the initial levels. On the other hand, the endoscope-assisted method already achieved an acceptable and good final occlusion. The traditional method had no fixture failures in RIF, while the endoscope-assisted method, the index reached 0-25%. Facial nerve paralysis has been more described in traditional treatment (7.5% -30 x 0-22%), and the loss of sensitivity was not reported in both treatments. Regarding to the time of surgery, this was higher in the endoscope-assisted method (RAFIR 40-120 min x 45-480 min), the total cost of the procedure was also higher when using the endoscope, because of the cost of equipment and increased use of the surgical room [10].

Another study evaluated the treatment of mandibular condyle fractures between 2005 and 2012. Fifty patients were evaluated with condylar fractures submitted to reduction surgery aided by endoscope. Postoperative Computed tomography (CT) of the facial bone tissue and panoramic radiograph demonstrated an appropriate reduction of fractures in all patients. There was no resorption of the mandible's head and most of patients showed a satisfactory functional and structural recovery. No damage to the facial nerve or transient loss of sensation was detected and there was no scarring visible after the surgery. The transoral endoscope-assisted treatment is a challenging, but reliable method, with lower morbidity and a quick recovery [7]. Although in this case report a combination of techniques was used, some studies suggest a proper repair purely with the use of transoral endoscopic, using short intramedullary segment titanium implants without the need for facial incisions or holes [21].

Conclusion

The use of endoscopy technique to reduce fractures localized in the upper portion of the mandibular ramus will contribute to achieve a more esthetic, less invasive surgical procedure with short recovery time and lower risk for the patient, offered that the specific indications.

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