



RESEARCH ARTICLE

EFFICACY OF LAG-SCREW OSTEOSYNTHESIS IN MANDIBULAR FRONTAL AREA: CASE STUDY

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ABSTRACT

The problem of maxillofacial injuries and improvement of treatment of fractures of facial bones of different localization does not lose its relevance. At the present stage of development of maxillofacial surgery, the preference is given to minimally invasive techniques of surgical treatment of mandibular fractures, which allow to restore the aesthetic and functional status of the maxillofacial area in shortest terms compared to the prolonged methods of conservative treatment. Availability of a wide range of fixing devices of a variety of designs, including miniplates, allows for adequate fixation of bone fragments, regardless of the localization and number of fractures. At the same time, given the functional peculiarities of biomechanics of the mandible, fixation of bone fragments by miniplates does not always provide the necessary "rigidity" of fixation, which may be accompanied by complications of a diverse nature. This provides basis for the elaboration of alternative methods of bone fixation, in particular using lag screws, the popularity of which has been increasing recently, as evidenced by the large number of publications in the professional literature. The proposed study presents a clinical case of a traumatic bilateral fracture of the mandible treated by the method of functionally stable osteosynthesis, when both miniplates and lag screws were used for fixation. A brief historical note on the application of lag screws is provided, the advantages and disadvantages of lag screw fixation are compared with traditional miniplates.

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INTRODUCTION

It is a well-known fact that mandibular fractures occupy a dominant position in the structure of traumatic injuries to the facial bones, and the main method of their treatment is a functionally stable osteosynthesis, the main purpose of which is to restore the anatomical form with particular attention to the establishment of the correct (premorbid) occlusion relationship, the provision of proper aesthetic status of the face and early functional rehabilitation of patients. While the principles of bone fragment fixation in the course of mandible fracture treatment with miniplates and mini screws, formulated by the representatives of the Association of Craniomaxillofacial Osteosynthesis (AO CMF) in the 1970s, do not raise any questions and their effectiveness has been proven in time, the use of lag screws as fixing elements is still actively debated by various schools of traumatology (Muller *et al*, 1970). According to one school of thought, the important factors limiting the widespread use of lag screws in the tooth-bearing jaw sections are high risk of damage to adjacent anatomical formations (mandibular canal, artery, lower alveolar or tibia nerves, roots of teeth, etc.) (Wahdan *et al*, 2016).

On the other hand, an important advantage of the above-mentioned screws is their ability to provide "rigid" fixation and interfragmental compression, which have a positive effect on the healing of the fracture (Rahn, 1987).

Case report

Patient K., born in 1978, was hospitalized to the Lviv Regional Clinical Hospital, the Department of Maxillofacial Surgery on November 13, 2017 with complaints of pain in the mandible at the opening of the mouth and while eating, bleeding from the oral cavity, impaired symmetry of the face. From the anamnesis, it is informed that the night before he was involved in the street fight near the night club and was punched in the face (more than once). He did not lose consciousness. After a clinical and X-ray examination, the patient was diagnosed with "Traumatic open bilateral mandibular fracture: in the right symphyseal area and left condylar area, with fragments displacement" (Fig.1). Electric pulp testing showed a decrease in sensitivity of the 31st and 41st teeth that were localized in the line of the fracture. In accordance with the principles of bioethics, the patient was informed of possible options of bone fixation, their advantages and disadvantages, the reasonableness of general anesthesia and recommended intra- and extraoral access to the corresponding anatomical sites of the mandible was substantiated and written informed consent was obtained for the proposed surgical treatment.

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On the 11.17.2017, under general anesthesia, an operation of osteosynthesis of the mandible was performed. Fixation of bone fragments in the area of the mandibular symphysis was done through intraoral access using two lag screws according to the following protocol. After infiltrative anesthesia of the surgical field for the purpose of hemostasis, a vestibular incision was performed on the transitional fold within the limits of 35th-45th teeth, taking into account the projection of the mental foramen. In the external (buccal) cortical plate of the mandible at the level of 33rd and 43rd teeth, two holes for fixing repositioning-compression forceps (Synthes®, Switzerland) were drilled (Figure 2). After the anatomical repositioning of bone fragments and thorough control of the state of the internal (lingual) cortical plate using a special tool (drilling guide, 10 cm drills with 1.5 and 2.0 mm in diameter) (Synthes®, Switzerland), 2 lag (compression) screws were inserted, 36 mm long in mutually opposite directions and maximally perpendicular to the plane of the fracture. Initially, the first screw was inserted, closer to the lower margin of the jaw, and after the control of the reposition, the second screw was inserted closer to the roots of the teeth, taking into account their localization (Fig. 3, 4, 5). A prerequisite for installation of lag screws was involvement of the vestibular cortical plate on both sides of the fracture line. Subsequently, the repositioning compression forceps were dismantled and the surgical wound was sutured with Seralon 4.0 (Wiessner-Serag®, Germany). For aesthetic reasons, the removal of 31st and 41st teeth from the line of the fracture was not carried out. Fixation of bone fragments in the left condylar area was performed via preauricular approach with two titanium miniplates and screws of the system 2.0 (Synthes®, Switzerland). Given the "rigidity" of the above variants of bone fixation, no additional intermaxillary immobilization was performed on the patient.

Postoperative care

In the postoperative period, the patient was prescribed with the analgesic (Analgin (Metamizole) 50%, 2 ml on request), anti-edema (Dexamethazone 4 mg 2 times daily during 3 days), antibiotic therapy (Dalacin C 300 mg, 3 times a day during 5 days) and mouth wash with chlorhexidine solution. Follow-ups were conducted on the 1,2,3,7,14,21,30 and 60 days after the fixation.

RESULTS

There were no significant complications in the course of postoperative period. Taking into account the fact that there wasn't any intermaxillary immobilization, the patient was receiving soft (liquid) food from the 2nd day after the operation, carrying out the metered functional load on the lower jaw and gradually increasing it. Under examination of the patient by bimanual palpation, no movement of fragments in the area of mandibular symphysis was detected. On the control X-ray, 1 day after osteosynthesis, a complete restoration of the anatomical form of the mandible (Fig. 6) was established. It was not possible to adequately assess the degree of active mouth opening in the case of applying lag (compression) screws due to the presence of another fracture in the condylar area, which made a wide opening painful, but the maximum inter-canine opening in the 30-day observation period reached normal values. During occlusion analysis with articulating paper, we did not detect any occlusion disturbances or significant deviations of occlusive contacts on the right and left.

It is important that the provision of interfragmental compression has allowed to preserve the 31st and 41st teeth in the fracture line, which was fundamental in an aesthetically significant area. Also, while at the time of hospitalization indicated teeth showed lower values of electrical sensitivity, within 2-3 weeks after osteosynthesis it dynamically increased and reached normal values on the 30th day of observation.



Fig.1. Ortho-panoramic X-ray of patient K., at initial examination. Diagnosed with "Traumatic open bilateral mandibular fracture; in the right symphyseal area and left condylar area, with fragment displacement"

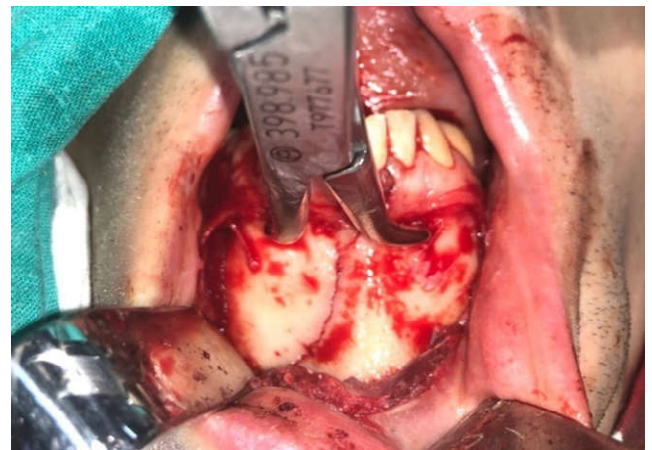


Fig. 2. Intraoral imaging of a patient K. Wide vestibular incision. Application of compression and reduction forceps (Synthes®, Switzerland)

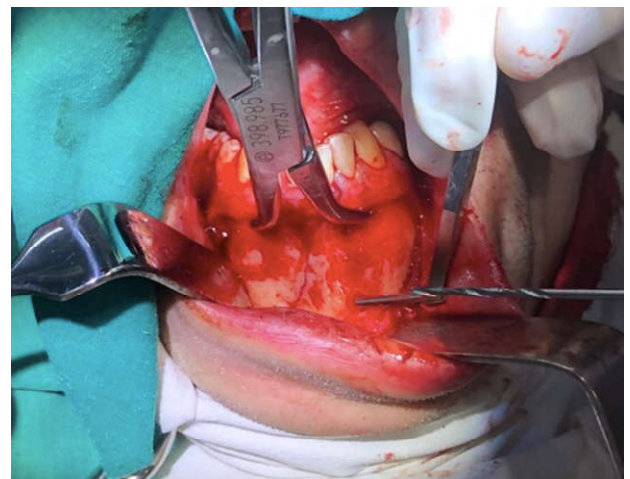


Fig. 3. Intraoral imaging of patient K. Drilling of the bone hole and insertion of the lower lag (compression) screw

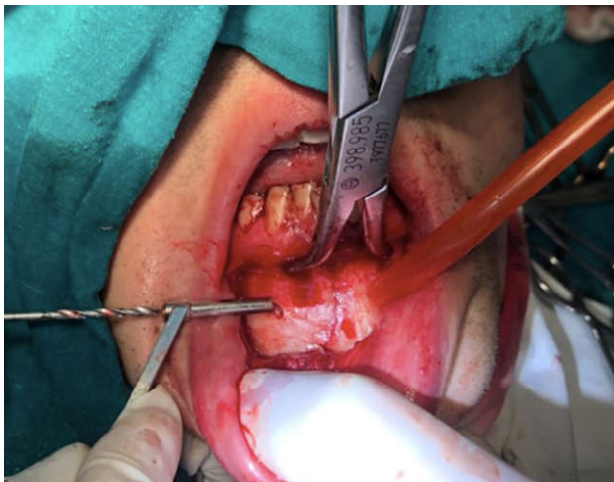


Fig.4. Intraoral imaging of patient K. Drilling of the bone hole and insertion of the upper lag (compression) screw

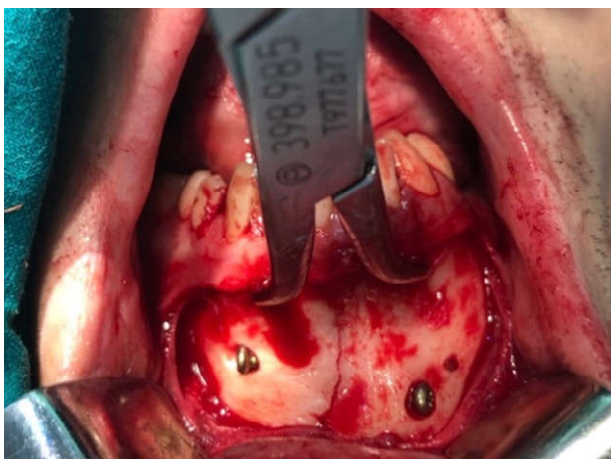


Fig. 5 Intraoral imaging of patient K. Fixation of symphyseal fracture with 2 compression screws. Detachment of compression and reduction forceps



Fig. 6. Control of ortho-panoramic X-ray of the patient. Complete restoration of the anatomical form of the mandible

DISCUSSION

As we know from the history of dentistry, compression or lag screws in the maxillofacial area were first applied by *R. Brons*, Bearing in 1970, who emphasized on their ability to provide "rigid" fixation of bone fragments and interfragmental compression, which positively affects the healing of the fracture overall.

Later, the technique was modified by employment of at least two screws, to prevent rotation of the mandible under functional loading. (*Niederdelmann et al, 1976*) Although today this technique is successfully applied under conditions of different localization of mandibular fractures, most researchers emphasize the highest appropriateness of using lag (compression) screws in the frontal area itself. (*Balasubramanian et al, 2014; Betharia et al, 2016*) In the opinion of the latter, the area of the mandibular symphysis and parasymphysis is convenient for intraoral access, visualization and manipulation with tools and compression screws in particular. As the findings of a series of below mentioned experimental and clinical studies suggest, one of the most important advantages of using lag screws is a significant reduction in the fracture line width due to interfragmental compression, which is a prerequisite for the so-called "primary" bone healing. By means of radiologic comparison of the fracture width in 30 patients, who underwent theosteosynthesis procedure in the frontal mandibular area by lag screws and miniplates, it was found that the distance between the fragments at all measuring points was significantly larger in the case of miniplates (*Goyal et al, 2012*). In a similar study it was confirmed a wider fracture gap in the lower jaw area when one or even two miniplates were used in comparison with lag screws (*Schaaf et al, 2011*).

Another advantage of lag screws is the "rigidity" of fixation. One recent biomechanical study demonstrated that the tensile strength as well as the resistance to compression and twisting forces of lag screws are much higher than in one or even two titanium miniplates (*Vieira eOliveira et al, 2011*). The clinical significance of the "rigid" fixation is, first of all, that it completely eliminates the need for intermaxillary fixation in the postoperative period and allows expanding the indications for preservation of teeth in the fracture line, which has a great aesthetic and functional significance.

REFERENCES

- Balasubramanian S., Kumaravelu C., Elavenil P., Krishnakumar Raja V.B. 2014. Solitary lag-screw fixation for mandibular angle fractures: Prospective study. *SRM J. Res. Dent. Sci.*, 5(3): 180-185.
- Betharia A.R., Dolas R.S. 2016. Efficacy of the Lag screw fixation for the treatment of anterior mandibular fracture. *Inter. Dent. J. Stud. Res.*, 4(3): 111-115.
- Brons R., Boering G.J. 1970. Fractures of mandibular body treated by stable internal fixation - a preliminary report. *Oral Maxillofac. Surg.*, 28: 407-415.
- Goyal M., Jhamb A., Chawla S. 2012. A comparative evaluation of fixation techniques in anterior mandibular fractures using 2.0mm monocortical titanium miniplates versus 2.4mm cortical titanium lag screw. *J. Maxillofac. Oral Surg.*, 2012: 442-450.
- Muller M.E., Allgower M., Willenegger H. 1970. Manual of internal fixation // New York: Springer-Verlag, 245 p.
- Niederdelmann H., Schilli W., Duker J., Akuuoma-Boateng E. 1976. Osteosynthesis of mandibular fractures using lag screw. *Int. J. Oral Surg.*, 5: 117-121.
- Rahn B.A. 1987. Direct and indirect bone healing after operative fracture treatment. *Otolaryngol. Clin. North Amer.*, 20: 425-440.
- Schaaf H., Kaubuegge S., Streckbein P., Willbrand J.F. 2011. Comparison of miniplate versus lag-screw osteosynthesis

- for fractures of the mandibular. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol.*, 111(1): 34-40.
- Vieira eOliveira T.R., Passeri L.A. 2011. Mechanical evaluation of different techniques for symphysis fracture fixation – an in vitro polyurethane mandible study. *J. Oral Maxillofac. Surg.*, 69(6): 141-146.
- Wahdan W.S., Kadry H.M., Ismail A.T. 2016. Evaluation of the Role of Lag Screw Technique in Internal Fixation of Mandibular Fractures: A Prospective Study. *Egypt. J. Plast. Reconstr. Surg.*, 40(1): 109-115.
