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### **CURRENT CONDITION, INDICATIONS AND CONTRAINDICATIONS OF CONSERVATIVE METHODS OF TREATMENT OF FRACTURES OF THE LOWER JAW**

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This review explores the conservative approaches to treating mandibular fractures, focusing on methods like intermaxillary ligatures, splints, and orthopedic devices. It details the fabrication and application of common splints, such as the Tigerstedt splint, and describes various types of intermaxillary fixation. The role of medication, including analgesics, antibiotics, and supplements, is discussed. The article also outlines indications for conservative treatment, including linear fractures without significant displacement, high-risk patients, and pediatric cases. Furthermore, it addresses potential disadvantages such as muscle atrophy, joint contractures, and occlusal dysfunction. The text also covers strategies for preventing complications in surgical treatment, emphasizing multidisciplinary approaches and evidence-based practices to improve patient outcomes.

**Key words:** mandibular fractures, fracture, lower jaw, mandibular, conservative treatment, intermaxillary fixation, splints, complications, prevention, surgical treatment.

### **Д.В. Стебловський, Д.С. Аветіков, О.С. Свирида, В.О. Личман, К.П. Локес, О.А. Торопов** **СУЧАСНИЙ СТАН, ПОКАЗАННЯ ТА ПРОТИПОКАЗАННЯ ДО КОНСЕРВАТИВНИХ МЕТОДІВ ЛІКУВАННЯ ПЕРЕЛОМІВ НИЖНЬОЇ ЩЕЛЕПИ**

У цьому огляді досліджуються консервативні підходи до лікування переломів нижньої щелепи, які зосереджувалися на таких методах, як міжщелепні лігатури, шини та ортопедичні пристрої. У статті докладно описано виготовлення та застосування звичайних шин, таких як шина Тігерштедта, і описано різні типи міжщелепної фіксації. Обговорюється роль ліків, включаючи анальгетики, антибіотики та добавки. У статті також викладено показання до консервативного лікування, зокрема лінійних переломів без значного зміщення, пацієнтів групи високого ризику та педіатричні випадки. Крім того, воно усуває потенційні недоліки, такі як атрофія м'язів, контрактури суглобів і оклюзійна дисфункція. Стаття також охоплює стратегії запобігання ускладненням під час хірургічного лікування, наголошуючи на мультидисциплінарних підходах і науково-обґрунтованих практиках для покращення результатів лікування пацієнтів.

**Ключові слова:** переломи нижньої щелепи, перелом, нижня щелепа, консервативне лікування, міжщелепна фіксація, шини, ускладнення, профілактика, оперативне лікування.

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Fractures of the mandible are one of the most frequent injuries of the maxillofacial area, which is a significant medical and social problem. These injuries may result from domestic, street, occupational, athletic, or transport-related trauma. Currently, there is a significant increase in the incidence of mandibular traumatic injuries caused by gunshot and blast-related trauma [8, 10]. It is noteworthy that mandibular fractures can also be of iatrogenic origin, occurring as a complication during the surgical extraction of impacted mandibular third molars or supernumerary teeth. The frequency of this complication ranges from 0.0033% to 0.0036% for intraoperative fractures and from 0.0042% to 0.0046% for postoperative fractures [8].

The nature of the fracture is also influenced by factors such as the anatomical features of the mandible and masticatory muscles, bone mineral density, and other physiological variables [18]. Based on the number of fragments and the configuration of the fracture lines, they can be classified into two categories: simple and complex. Simple fractures are linear and characterized by the presence of two bone fragments. Complex

fractures involve at least two fracture lines with three or more fragments. This category includes segmental, comminuted, and defect-associated fractures (bone loss). In the presence of infectious complications or mandibular atrophy, the fracture is also clinically defined as complex [6, 15, 30].

Their treatment requires an integrated approach and may include both conservative and surgical methods. Since the mandible is the only mobile, load-bearing bone of the skull, a thorough understanding of the fundamental principles of fracture fixation is essential for a clinician to ensure adequate treatment outcomes [22, 24]. Despite significant advances in modern maxillofacial surgery, conservative treatment remains relevant in certain clinical situations. It is used for uncomplicated fractures or as a temporary measure. Understanding the indications, limitations, and potential complications of conservative methods is critical to ensuring optimal treatment outcomes. In cases where the reduction of fragments is anatomically inaccurate, the risk of both short-term and long-term postoperative complications increases; for this reason, load-bearing fixation is mandatory in complex fractures to achieve maximum stable repositioning [7]. In addition, despite the improvement of surgical techniques, the risk of intra- and postoperative complications remains, which emphasizes the need to develop and implement effective preventive strategies. This literature review aims to systematise current knowledge regarding conservative treatments for mandibular fractures and strategies for preventing complications arising from both conservative and surgical treatments [21, 32].

**The purpose** of the study was to review modern conservative methods of treatment of lower jaw fractures, determine the indications and limitations of their use, as well as analyse strategies for the prevention of intra- and postoperative complications in surgical treatment, with an emphasis on a multidisciplinary approach and evidence base.

The analysis of literary sources of domestic and foreign authors was carried out. For this, the electronic database of medical and biological publications Scopus, Pubmed and Web of Science was used. The search depth was 5 years. The literature search was conducted in Ukrainian and English, The last search date was 27Oct2025 (the latest source was published on May 2025).

During analyzing of literature date we included such types of studies as randomized controlled trials, observational studies, and we also used articles devoted to meta-analysis of methods of mandibular fractures treatment and its complications. After conduction of analysis, the references of the selected articles were searched. During articles selection we have done the reviewing their titles and abstracts as well as from the bibliography of the selected articles.

Keywords used to search for relevant articles included “mandibular AND fractures” “mandible OR lower jaw” “osteosynthesis” “intermaxillary fixation” “conservative treatment AND mandible fracture” “mandible fracture AND treatment NOT surgical”. These terms were used individually and together to ensure an extensive literature search.

Articles that were clinical cases or editorials, letters, commentaries, and conference abstracts were excluded from the search. As well as articles describing guidelines for how to read or interpret a systematic review or meta-analysis, were also excluded. Publications that were not focused specifically on the selected topic were excluded of this article.

The full texts of all studies of relevance were then obtained for independent assessment by the reviewers, and any disagreement was resolved by discussion with all co-autors of this article.

Table 1

Simplified PRISMA Flow

Stage	Description	Number of Records/Studies
1. Identified	Total number of records identified through database searching and other sources	129
2. Duplicates Removed	Number of records removed before screening (e.g., duplicates)	28
3. Screened (Title/Abstract)	Number of records screened after duplicates were removed	25
4. Assessed for Eligibility (Full-text)	Number of full-text articles assessed for eligibility against the inclusion/exclusion criteria	35
5. Included in Review	Total number of primary studies finally included in the systematic review	41

The fundamental aspect of fracture management is the fixation of bone fragments, the quality of which directly dictates the healing mechanism and the risk of complications [20]. Fixation can be categorized into rigid and non-rigid types. Under rigid fixation, bone fragments are completely immobilized, allowing for primary bone healing without callus formation. Such methods include the use of mini-plates and screws on each side of the fracture line or reconstruction plates with three screws per side. Conversely, non-rigid fixation is characterized by the micro-mobility of fracture fragments, which

induces secondary bone healing through callus formation. This type of fixation is primarily associated with conservative treatment modalities for mandibular fractures [11, 26].

Conservative treatment of mandibular fractures has some advantages, such as preventing the formation of postoperative infection, hematoma or visible scars on the skin of the face. Another factor for choosing this treatment method is the less complex techniques of its implementation than surgical interventions, namely osteosynthesis. Therefore, conservative treatment of mandibular fractures can be successfully performed by a maxillofacial surgeon with little experience. Another positive socio-economic aspect of choosing a conservative method of treatment of mandibular fractures is its lower cost compared to osteosynthesis using titanium mini-plates [5, 17, 36].

Currently, the indications for conservative treatment of mandibular fractures are limited. This method may be indicated in children or patients with poor general health, when general anesthesia is contraindicated. It can also be used in cases where the occlusion is slightly altered and in fractures without significant displacement, i.e., with direct contact between the damaged bone fragments [17, 22].

Conservative treatments for mandibular fractures include reposition of bone fragments and its stabilization without surgical incisions or osteosynthesis. The main approaches are immobilization by aluminium ligatures and splints. Mass-produced splints, such as the Vasilyeva splint, are convenient for urgent use, but impossible for customization. Individually manufactured splints, in particular the Tigerstedt splint, offer better compliance with teeth, increased stability and consideration of fracture features [15]. The technique of applying the split includes sanitation of the oral cavity, precise fitting of the tire to the teeth and its attachment by ligature binding. Inter-slot fixation is provided by elastic rubber rings or wire ligature attached to hooks on the tire [34].

There are one-sided (with unilateral fractures without significant displacement), two-sided rigid (with bilateral fractures with displacement) [4] and gentle fixation (with temporary removal of rods for hygiene and functional activity). Monitoring during immobilization (4-6 weeks) includes clinical and radiological examination [15].

Immobilization with orthopedic devices includes a chin sling with a head cap (Pomerantseva-Urbanskaya apparatus, Port splint), Petrov apparatus (for fractures of the temporomandibular joint). In complex cases, individual orthopedic constructions using CAD/CAM and 3D-modules are used to accurately restore the anatomical shape [31, 40].

In select cases, mechanical fixation of mandibular fragments using orthodontic brackets may be considered for treatment. However, this modality is limited to minimally displaced or favorable fractures where minimal reduction and stabilization forces are sufficient, as orthodontic brackets can withstand only limited tensile forces. Furthermore, there is a risk of bracket displacement or debonding due to routine oral functions or patient non-compliance with clinical instructions. Nevertheless, this treatment method offers several distinct advantages, including the continuity of orthodontic treatment and a reduction in both operative time and clinical effort due to the simplified fixation process [2].

Drug therapy includes analgesics (NSAIDs, opioid analgesics), antibacterial therapy (with open fractures or the risk of infection), anti-inflammatory drugs (NSAIDs, glucocorticosteroids), calcium and vitamin D drugs to stimulate osteogenesis [16, 29, 38].

Indications for conservative treatment are linear fractures without displacement or with slight displacement, high risk of postoperative complications, fractures in children with lactic occlusion, isolated fractures of the temporomandibular joint without significant displacement, and also as a temporary measure before surgery [13, 23].

Disadvantages of conservative treatment are as follows: prolonged immobilization can lead to weakening of the masticatory muscles, contractures and ankylosis of temporomandibular joint. There is a risk of additional movements of bone fragments and the impossibility of accurate anatomical reposition, which can cause occlusion disorders and post-traumatic deformities. There is a risk of pain dysfunction of temporomandibular joint. The patient needs strict adherence to diet and hygiene recommendations, which can lead to vitamin deficiency and weight loss [7, 33].

Complications following the treatment of mandibular fractures range from minor wound infections and impaired wound healing to more severe conditions, such as surgical wound dehiscence with exposure of fixation hardware, the development of osteomyelitis, and impaired osteogenesis, which may ultimately lead to non-union (pseudarthrosis) [10]. The development of post-treatment complications is influenced by various factors: smoking and alcohol abuse, delayed seeking of medical attention, the presence of a tooth in the fracture line, the severity of the injury, and the chosen treatment modality [22].

Intraoperative complications can occur in the form of: damage to the neurovascular structures (lower alveolar, marginal branch of the facial nerve, mental nerve, facial artery and vein). Prevention is based on knowledge of anatomy, gentle preparation, the use of neuronavigation and piezosurgery [7, 25]. Prevention of bleeding includes: adequate hemostasis, control of hemodynamic parameters, it is also important to carry out prevention of dental injury, careful preoperative planning [1], MSCT, the use of

surgical templates, intraoperative X-ray control. Preventive measures in case of incorrect reposition of fragments are based on: jaw models for occlusion control, intraoperative X-ray control, navigation systems and 3D-modelling [1, 41]. To prevent intraoperative infection, strict adherence to aseptics and antiseptics, oral sanitation, preventive antibiotic therapy is important. To prevent postoperative complications such as infectious complications (suppuration of the wound, osteomyelitis), it is necessary to ensure careful hemostasis, drainage, rational antibiotic therapy, sanitation of infectious foci [29, 39].

Also, postoperative complications include delayed consolidation, mobility of fragments, bone resorption around implants or postoperative deformation. Preventive measures include: the correct choice of fixing structures, adherence to the technique of osteosynthesis, blood supply control, stable fixation, restriction of movements, additional methods of immobilization, biocompatible materials, correct positioning, sanitation of infections, correction of metabolic disorders, accurate anatomical repositioning, 3D-planning navigation. It should also be noted nerve damage leading to paresthesia, anesthesia, preventive measures are based on: precision preparation, knowledge of anatomy, and neuronavigation [1, 31].

Conservative treatments for mandible fractures, despite the development of surgical techniques, remains an important component of the treatment process [37], especially in cases of uncomplicated fractures, in patients with high surgical risk or in pediatric practice. The widespread use of individual splints, such as the Tigerstedt splint, allows for better adaptation and stability of fixation compared to serial counterparts [12, 28]. However, prolonged immobilization, which is characteristic of conservative treatment, can lead to complications such as atrophy of the masticatory muscles, contractures and dysfunction of the temporomandibular joint. These shortcomings highlight the need for careful selection of patients for conservative treatment and continuous monitoring of their condition [19].

However, when choosing a conservative treatment for a mandibular fracture, one should be aware of the possible suboptimal functional outcomes. Important factors are bone resorption and masticatory muscle atrophy, which can occur after conservative treatment of a unilateral articular head fracture. Therefore, when choosing a conservative treatment for articular process fractures, it is necessary to clearly establish the indications for this treatment method and take into account the possible negative outcome [5, 14, 17].

At the same time, the prevention of complications is the cornerstone of successful treatment of fractures of mandible, regardless of the chosen method. In surgical practice, deep knowledge of topographic anatomy, the use of modern technologies such as neuronavigation, piezosurgery and 3D-planning are key, which allow minimisation of the risks of damaging the neurovascular structures, damaging of the teeth and ensuring accurate reposition of fragments. Strict adherence to the principles of asepsis and antisepsis, as well as rational antibiotic therapy, are critical to prevent infectious complications [3, 4, 31].

It is important to note that conservative treatment of mandibular condylar process fractures leads to complications in the vast majority of cases. The condylar fragment often displaces medially, obstructing mandibular movement and resulting in restricted mouth opening. A reduction in the height of the mandibular ramus, caused by the fracture and subsequent bone resorption, led to chin deviation toward the affected side or retrusion in cases of bilateral fractures [5, 7, 35].

The importance of a multidisciplinary approach cannot be overemphasized [23], since it allows you to comprehensively take into account the individual characteristics of the patient, concomitant diseases and psycho-emotional state. Early functional rehabilitation, including special exercises and physiotherapy, is mandatory to restore the functions of chewing, facial expressions and prevent the development of contractures.

Promising directions, such as the development of new biomaterials, tissue engineering [31] and personalised medicine, promise further improvement of treatment results and reduction of complications. In general, effective treatment of mandibular fractures requires a combination of informed choice of method, precision technique, preventive measures and comprehensive postoperative management.

In our literature review, we focused on the specific aspects of conservative treatment for fractures in children. The unique anatomical and physiological characteristics of the pediatric mandible — specifically its more pliable bone structure and the presence of deciduous or mixed dentition — necessitate a distinct approach to managing such injuries. In these cases, the primary objective is not only to achieve stable fixation of the bone fragments but also to consider the impact of the chosen treatment on the growth and function of the bone [9]. This underscores the importance of meticulously accounting for the long-term consequences of any treatment plan on a child's developing craniofacial structures to ensure optimal healing and prevent potential complications [13, 34].

The treatment of mandibular fractures in children is complex and requires careful consideration of various factors. Conservative treatment should be the first choice, with open reduction and internal fixation reserved for specific cases [27]. To minimize the risk of damaging permanent tooth follicles and to promote the proper development of oral structures, some authors recommend the use of a quartz splint. This device stabilizes the mandibular arch while maintaining the position of the maxilla. Literature sources report that

this method provides reliable stabilization of the mandibular arch, highlighting its cost-effectiveness, reduced surgical trauma, and lower risk of complications [15].

Our study was subject to several limitations. First, the literature review primarily focused on sources published within the last five years; this timeframe may be insufficient given the current predominance of surgical interventions in modern oral and maxillofacial surgery. Second, our analysis was restricted to Ukrainian and English-language sources, which may have limited the overall volume of information retrieved. Third, discrepancies between Ukrainian and English classification systems hindered the efficient processing and synthesis of the collected data.

### Conclusions

1. Conservative treatments for mandibular fractures, including immobilization by aluminium ligatures, splints, and orthopedic devices, remain relevant for uncomplicated fractures, in patients at high surgical risk, in children, and as a temporary treatment method.

2. The manufacture of individual splints, in particular Tigerstedt splints, provides better stability and compliance with the individual anatomical features of the patient compared to serial products, but dramatically reduces the state of oral hygiene in the postoperative period.

3. The main disadvantages of conservative treatment are the risk of developing atrophy of the masticatory muscles, contractures, dysfunction of the temporomandibular joint, as well as the lack of the possibility of accurate anatomical reposition of the fragments.

4. Prevention of intra- and postoperative complications in the surgical treatment of fractures of the lower jaw requires a multidisciplinary approach, careful preoperative planning, the use of modern surgical technologies (neuronavigation, 3D-planning, piezosurgery) and strict adherence to the principles of asepsis and antiseptics.

5. Early functional rehabilitation and comprehensive postoperative monitoring are critical to restore function, prevent complications and ensure optimal treatment outcomes.

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