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Intermaxillary fixation of mandible fractures in military personnel: case report

Background. *The treatment and rehabilitation of military servicemen with mandibular fractures at the hospital stage is an important medical, social, and economic problem.*

The purpose of the study. *The purpose of this study was to improve the effectiveness of the mandible fractures treatment in military personnel by analyzing clinical cases with using intermaxillary fixation.*

Materials and methods. *A clinical study was conducted for the period from 2012 to 2019 in 63 military servicemen with mandibular fractures, 23 of which suffered civilian trauma, but the overwhelming majority (40 men) were injured during warfare in eastern Ukraine in the 2014–2019 as a result of combat injuries. The analysis of the potential use for the fragments intermaxillary fixation standard band splint vs the titanium pins and elastic traction for the treatment of mandibular fractures in military personnel has been carried out.*

Results. *On the results of seven-year findings of administration to military servicemen injured during the war on the East of Ukraine, the advantages of using maxillomandibular fixation with Screws for the treatment of mandibular fractures both in cases of linear mandibular fractures and fragment fractures with bone tissue defects as a method of adjunctive fixation in combination with osteosynthesis and bone shaping were illustrated. In this article, we presented three most demonstrative cases.*

Conclusion. *Preference during surgical treatment of mandibular fractures in military personnel should be given to the method of maxillomandibular fixation with intermaxillary fixation screws, which provides with the high quality reposition and fixation.*

Keywords: *mandibular fracture, intermaxillary fixation, titanium pins.*

Over the last decade, there has been an increase of the traumatic injuries occurrence of the maxillofacial area, of which mandibular fractures (MF) rank high. The imperfection and costly characteristic of MF treatment methods are vividly sensed by practicing maxillofacial surgeons within the conditions of action operation and protracted military conflicts in the context of modern wars [15]. The specialty of deliver health care in these settings is associated primarily with the fact that hostilities break out in direct proximity to populated locality, residential areas, motorways and other communication routes [2]. The fast-paced combat situation requires an adequate response in the deployment of medical aid stations, and specialized medical care is often provided in medical centers at a distance of hundred kilometers from the line of army actions. However, most of the focus is on life support, clear airway, temporary hemostasis and anti-shock measures [20].

Thus, the patients with MF usually do not receive adequate medical care at the triage stage, which is due to two defining points: firstly, most particularly and absolutely justified when MF is combined with other severe injuries, an emergency capacity of medical care are provided and further immobilization of MF fragments is carried out already in hospital; secondly, patients with MF in a satisfactory condition are rendered a minimal attention at the prehospital stage for saving time, what is especially important in the case of massive injections of wounded [14].

It is also important to note that MF in military personnel also occurs as a result of home traumatism, and due to the specificity of the symptoms and the peculiarities of specialist help the diagnosis and transportation of such patients are often tardy, the requirements of transport immobilization are not met, that certainly causes more long-term complications [10].

Considering the above, the treatment and rehabilitation of military servicemen with MF at the hospital stage is an important medical, social and economic problem that requires the health care system resources mobilization and significant costs [18].

The purpose of the study. A prospective study of patients being treated for mandible fracture with intermaxillary fixation was designed. The purpose of this study was to improve the effectiveness of the mandible fractures treatment in military personnel by analyzing clinical cases with using intermaxillary fixation.

Materials and methods

A clinical study was conducted for the period from 2012 to 2019 in 63 military servicemen with MF, 23 of which suffered civilian trauma, but the overwhelming majority (40 men) were injured during warfare in eastern Ukraine in the 2014–2019 as a result of combat injuries. All patients received

tardive specialized medical care (later than 24 hours after injury) in the Dnieper Military Hospital or Dnieper regional clinical hospital. The verification of the clinical diagnosis was carried out on the basis of clinical and X-ray pattern (orthopanthograms, the cranial X-rays in frontal and lateral projection).

The intermaxillary fixation with using of standard band splints (Vasiliev, Erich) was basic method of treatment for the period from 2012 to 2014. However, the discovered defect of this technique served as an objective basis for revising the algorithms for providing specialized care and finding more effective techniques that meet the military maxillofacial surgery needs.

Results

The opportunities of intermaxillary splinting for treatment of MF in military personnel

It has been observed that the method of intermaxillary splinting in military personnel is the least invasive, simple and inexpensive way of MF treatment. However, it showed low efficacy in cases of displaced MF and required additional time for postoperative correction of the fragments position.

For illustrative purposes, here is a brief description of the case. The patient G., 21 years old, was admitted to the clinic on the second day after a civilian trauma. Diagnosis: Mandibular fracture in the area of 32, 33 teeth (Fig. 1A).

On the primary orthopanthogram noted the displacement of a large fragment downward with the formation of a step on the mandibular lower edge, the diastase between the fragments is 5 mm (Fig. 1C).

On the day of hospitalization, the band splints were applied, manual repositioning of mandibular fragments, apposition of teeth in occlusion and fixation with the rubber ring tractions were performed.

However, on the 7th day on the orthopanthogram a displacement of fragments revealed up to 2 mm and disocclude between the 45, 44, 43, 42, 41, 31, 32 teeth (Fig. 1D).

With the purpose of fragment apposition correction, on the 7th day the mandibular band splint was cut at the level of the line fracture and changed the direction of the rubber tractions action, intermaxillary elastic traction was removed on 21st day (Fig. 1B).

The repeated radiography proved the completeness of the mandible reposition and the restoration of occlusion in the area of 45, 44, 43, 42, 41, 31, 32 teeth (Fig. 1E).

Thus, the laboriousness of the intermaxillary splinting and the need for subsequent correction limit the possibilities of its use in the event of massive injury of wounded.

Fig. 1

A, B – The interrelationship of mandible fragments before and on the 21st day after the splintage, respectively.

C, D, E – The orthopanthogram of the jawbones before treatment, on the 7th and 21st day after fixation of the standard tape splint, respectively

The opportunities of MMF with IMF Screws for treatment of military personnel with MF

The seven-year clinical observations have shown the advantages of MMF fixation in military personnel, as a simple, minimally invasive. and reliable method of fixing mandibular fragments, which easily allows postoperative correction of their position, if necessary.

For illustrative purposes, here is a brief abstract of case history. The military serviceman P., 22 years old, suffers as a result of the explosion the soft tissue bruise of the right orbital and zygomatic areas, and mandibular fracture in the area of 34, 35 teeth. The specialized medical care is provided in the first 24 hours. After local anesthesia (Articaine infiltration) has performed the primary surgical treatment of wound, MMF with six IMF Screws in interradicular spaces behind the canines on either side and vertically running wire loops secures a firm centric occlusion (Fig. 2, 3).

Fig. 2. The interrelation of mandible fragments in serviceman P., after reposition and MMF with IMF Screws

Fig. 3. The orthopanthogram of the jawbones of the same patient after reposition and MMF with IMF Screws

MMF with IMF Screws also well recommended as an additional method of fixation at the gunshot fragment wounds of the mandible with major defects of bone tissue, which provides the occlusion adjunctive fixation after extensive osteosynthesis and prevents the convergence of fragments, the development of mandible pronounced deformities.

As an example, we will give the following clinical case: a volunteer soldier M., 56 years, received a mandibular comminuted fracture as a result of a mine-blast trauma. It was decided, after emergency actions, the primary surgical treatment of face wounds to replace the major defect of the mandible after completion of treatment in the intensive care unit. The replacement of the mandibular defect was performed under general anesthesia in the maxillofacial department (Fig. 4).

Fig. 4. The orthopanthogram of the jawbones of volunteer soldier M., 56 years

For the fixation of fragments, we used the titanium plate; for the adjunctive fixation, prevention of fragments convergence and savings of the repaired occlusion we used the MMF with IMF Screws.

Fig. 5. The cranial X-ray of the same patient after osteosynthesis and MMF with IMF Screws: A - front projection, B - lateral projection

This tactic allowed for complete rehabilitation of the patient in 6 months; on his own volition, he had served with the Ukrainian military.

Discussion

It is not provoking a discussion that available materials should be used for the treatment of military personnel with MF, which make it possible to provide a protection for the maximum number of victims in cases of massive injections of wounded [5].

Despite the popularity of operative methods of repositioning and fixation, in modern medicine there is a gradual trend that inclines to the searching for less invasive, more attenuated, atraumatic treatments that do not require significant costs from the health care system [13].

According to the overwhelming majority of experts, the method of intermaxillary splinting has definitive advantages in the social aspect and significantly reduces the medical expenses. Just while the dual arch toothlessness or tooth insufficient quantity, in case of their mobility, occlusion anomalies, inability to perform accurate closed reduction as an alternative surgery should be considered [7]. Thus, definite margin of superiority in clinical settings are given to conservative-orthopedic methods of repositioning mandibular fragments [3]. However, up-to-date most splinting devices, which are used in clinical settings, have fundamental defects and are inadequate to the life [1].

The imperfection of the actual technique of intermaxillary splinting is primarily due to the possibility of repeated displacement of the jaw fragments during the splintage, which further stabilize the incorrect interrelationship of fragments and teeth in the occlusion [4]. For remediation of the situation, is possible saw the splint at the level of the fracture line, for the sequel controlled reposition with rubber tractions [6].

However, this procedure requires enough time and effort. In addition to the time spent on the splinting and the fragments repositioning, it is necessary in the future to cut the splint, change the elastic rods for controlled reposition.

That is why there is an acute need in development of the new innovative technologies of closed repositioning and splinting devices, which would have high atraumatic and hygienic and would remain relatively inexpensive [9]. The techniques that allow to go back of dental splinting structures, while maintaining the principle of intermaxillary fixation, carried out using intraosseous screws or pins, are in great popularity (Maxillomandibular Fixation (MMF) with Intermaxillary fixation (IMF) Screws) [16].

Such technique is less laborious and safer in cases of increased risk of staff infection with hepatitis and HIV viruses, but during its use there are substantial risks of teeth roots injury by the pins, comminuted fractures of the maxillary frontal cortical plate [12].

It is obvious that minimally invasive and atraumatic techniques should be preferred for MMF with IMF Screws use in military personnel [19].

The evidence from our 7-year experience of healthcare delivery to wounded military servicemen during the anti-terrorist operation in eastern Ukraine shows that protocol set of four MMF screws in the interradicular spaces behind the canines on either side and vertically running wire loops secures a firm centric occlusion has proven oneself in the best possible way [11]. Also, this position of the screws provides with maximum retention of the fragments in the correct position during the whole period of fixation.

The longer the distance between the fixation points, the greater the force moment when tightening the ligatures. For achievement of direct proximity of the anchors within the opposite dentoalveolar ridges the MMF screws have

placed in the interdental / interroot bone spaces. As a result, tension and the risk of rotational displacement of the bone and malocclusion are reduced. For any standardized screw location or cerclage protocol an individualized placement of MMF screws and a well-tailored consecutive ligature arrangement is advantage, most notably at previous dental malocclusion or dentofacial deformities [8].

We should pay attention to the advantages of MMF with IMF Screws as an additional method of fixation at the gunshot fragment wounds of the mandible with major defects of bone tissue, which provides the occlusion adjunctive fixation after extensive osteosynthesis and prevents the convergence of fragments, the development of mandible pronounced deformities [17].

Conclusion

Thus, for the operative treatment of mandibular fractures in military personnel preference should be given to method of MMF with IMF Screws, which provides with the high quality reposition and fixation. At the same time, due to the absence of rigid fixation devices in the area of the fracture line, it is possible (if necessary) to produce a postoperative correction of the fragments position by the rubber rods (elastics). In these conditions such complications as occlusion disorders, malunion, delayed consolidation minimize.

MMF with IMF Screws does not require a wasteful of time and volumetric funding, which is especially important for providing medical care to the maximum number of victims in cases of massive injection.

In conclusion, the usage attainment of MMF with IMF Screws must have perfected at the oral surgeons and maxillofacial surgeons, which administering to armed forces personnel both in peace-time and especially in the region of military conflicts.

Trial registration: The work is a fragment of the research project of the Oral Surgery, Implantology and Periodontology Department of Dnipro State Medical University: «Development of methods for the prevention of complications in the treatment of inflammatory state and traumatic injuries in the maxillofacial area», state registration № 0113U005253 and applied research carried out in 2020–2023 at the expense of the government funding «The prognosis, prevention and treatment of delayed union of bone tissue in patients with fractures of the jaws» № 0121U109420.

No conflict of interest.

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Міжщелепна фіксація переломів нижньої щелепи у військовослужбовців: клінічний випадок

Резюме

Вступ. Лікування та реабілітація військовослужбовців із переломами нижньої щелепи на госпітальному етапі є важливою медичною, соціальною та економічною проблемою.

Мета роботи. Метою цього дослідження було підвищення ефективності лікування переломів нижньої щелепи у військовослужбовців шляхом аналізу клінічних випадків з використанням міжщелепної фіксації.

Матеріали та методи. Було проведено клінічне дослідження за період 2012–2019 рр. з участю 63 військовослужбовців із переломами нижньої щелепи, 23 з яких отримали побутові травми, але переважна більшість (40 чоловіків) були поранені під час бойових дій у 2014–2019 рр. на Сході України. Проаналізовано можливості використання для лікування переломів нижньої щелепи у військовослужбовців міжщелепної фіксації відламків стандартними стрічковими шинами порівняно з титановими пінами та еластичною тягою.

Результати та обговорення. За результатами даних семирічних спостережень ведення військовослужбовців, які постраждали під час війни на Сході України, були продемонстровані переваги використання міжщелепної фіксації гвинтами для лікування переломів нижньої щелепи як у разі лінійних переломів нижньої щелепи, так і осколюватих переломів з дефектами кісткової тканини як метод додаткової фіксації в поєднанні з остеосинтезом та формуванням кістки. У цій статті ми представили опис трьох найбільш типових клінічних випадків.

Висновки. При оперативному лікуванні переломів нижньої щелепи у військовослужбовців слід віддавати перевагу методу міжщелепної фіксації за допомогою гвинтів, що забезпечує високоякісну репозицію та фіксацію.

Ключові слова: перелом нижньої щелепи, міжщелепна фіксація, титанові піни.

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Межчелюстная фиксация переломов нижней челюсти у военнослужащих: клинический случай

Резюме

Введение. Лечение и реабилитация военнослужащих с переломами нижней челюсти на госпитальном этапе является важной медицинской, социальной и экономической проблемой.

Цель работы. Целью исследования было повышение эффективности лечения переломов нижней челюсти у военнослужащих путем анализа клинических случаев с использованием межчелюстной фиксации.

Материалы и методы. Проведено клиническое исследование за период 2012–2019 гг. с участием 63 военнослужащих с переломами нижней челюсти, 23 из которых получили

бытовые травмы, но подавляющее большинство (40 человек) были ранены во время боевых действий в 2014–2019 гг. на Востоке Украины. Проведен анализ возможности использования для лечения переломов нижней челюсти у военнослужащих стандартной ленточной шины для межчелюстной фиксации отломков в сравнении с титановыми пинами и эластичным вытяжением.

Результаты и их обсуждение. По результатам данных семилетних наблюдений ведения военнослужащих, пострадавших во время войны на Востоке Украины, были продемонстрированы преимущества использования межчелюстной фиксации винтами для лечения переломов нижней челюсти как в случае линейных переломов нижней челюсти, так и оскольчатых с дефектами костной ткани как метод дополнительной фиксации в сочетании с остеосинтезом и формированием кости. В этой статье мы представили три наиболее типичных клинических случая.

Выводы. При оперативном лечении переломов нижней челюсти у военнослужащих следует отдавать предпочтение методу межчелюстной фиксации с помощью винтов, который обеспечивает высококачественную репозицию и фиксацию.

Ключевые слова: перелом нижней челюсти, межчелюстная фиксация, титановые пины.

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