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Periodontal condition and oral hygiene of patients with jaw fractures during maxillo-mandibular fixation and other immobilization methods

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Abstract

The aim of this article is to review and combine scientific studies on the condition of periodontal and oral hygiene in patients with jaw fractures during the immobilization period using different methods.

Background: This review article briefly discusses the essence of research devoted to the study of periodontal and oral hygiene in the period of immobilization in patients with jaw fractures. Despite that the practice is implemented at a number of new methods of treatment of jaw fractures, splinting is still one of the main methods in many countries. The essential drawbacks of the existing methods of intermaxillary fixation, particularly dental arch bars and ligatures, are negative influence on periodontium, complicated hygiene, non-balanced muscular loading, pain and psychological discomfort to the patient etc, which requires a search for alternative methods.

Results: An electronic search was conducted across PubMed, Elsevier, Google scholar, Google search, Research Gate, Ebsco Host, dissercat.com, medical-diss.com, cyberleninka.ru and other possible sites for the purpose of literature analysis on the mentioned topic in Russian and English. The studies were reviewed and compared. This article summarizes the recent advances about oral conditions during treatment jaw fractures.

Conclusion: Along with the main treatment, the oral cavity sanitation, the condition of oral hygiene and periodontal disease are fundamental factors for the successful treatment of patients with mandibular fractures. In the period of immobilization, along with the main treatment, it is necessary to pay attention to a complex of measures to improve oral hygiene and prevent the progression of inflammatory and destructive changes in periodontal tissues in patients with inflammatory periodontal disease in combination with jaw fractures.

Clinical significance: The high prognostic significance of the periodontal status of these patients explains the need for timely and accurate diagnosis of this condition. Comprehensive care for the oral cavity prevents the progression of destructive processes in periodontal tissues and reduces the risk of complications and creates optimal conditions for a favorable outcome of mandible fractures during the treatment.

Keywords: Mandibular fracture, maxillofacial trauma, intermaxillar fixation, oral hygiene, periodontium, complication

Introduction

The aim of this article is to review and combine scientific studies on the condition of periodontal and oral hygiene in patients with jaw fractures during the immobilization period using different methods.

Review results : The articles were identified using the computerized search engine PubMed, Elsevier, Cochrane Central, Google scholar, Google search, Research Gate, Ebsco Host, dissercat.com, medical-diss.com, cyberleninka.ru and other possible sites with keywords such as maxillofacial trauma, mandibular fracture, jaw fracture intermaxillar fixation and rehabilitation, oral hygiene, periodontium, complication and in various combinations of these words in Russian and English. And they also took into account the relevant bibliographic lists. Randomized controlled trials, meta-analyzes, prospective clinical trials were selected based on their significance.

Backgrounds. Periodontal and hygienic condition during immobilization via splinting

The method of two-jaw splinting, the most common in clinical practice and, according to various authors, account for up to 87% of the total number of treatment measures [5, 9]. These methods provide for the fixation and immobilization of the mandible fragments by intraoral splints, mainly wiry dental splints with maxillary traction. Most often, these are individual Tigerstedt's splints offered by him back in 1915; or Erich's splints, which are fixed on the teeth in the cervical area using ligature wire. This method differs from others by minor injury and applying simplicity, cheapness of used materials, but have several significant drawbacks: they are cumbersome, especially for urgent opening of the mouth with traumatic brain injury, inconvenient for eating and maintaining oral hygiene; lead to damage to the mucous membrane of the lips, cheeks, as at the time of fixation of the splints, so throughout the time they are in the mouth, an inevitable injury occurs to the marginal part of the periodontal complex. A number of authors have confirmed the negative effect of splints on periodontal and dental status [5-9, 11, 18, 19, 22, 29, 31, 35]. Periodontal inflammation occurs in all patients with mandibular fractures with splinting, on tooth range, and in many patients there is a progression of inflammatory and destructive processes. Although these limited marginal periodontal changes are reversible, they are the cause of patients' complaints about discomfort and pain in these localizations. Significant deterioration of the hygienic condition of the oral cavity in combination with the traumatic impact of fixing structures leads to the development of pathology in the marginal periodontal area, or the latter aggravates the existing one, leading to displacement, stretching and loosening of the teeth at the 3rd-4th week. This is especially expressed in the treatment of mandibular fractures, when it is almost impossible opening of patient's mouth. In the treatment process of patients with mandibular fractures in oral cavity develops a negative cariogenic reaction [6, 10, 26, 36].

The results of the Kutsenko's study showed that, in most cases these periodontal changes were persistent and remained with a slight positive trend for 6 months [7]. Thor and others determined negative changes one year after treatment with orthopedic methods [36]. Therefore, patients with mandibular fractures during periodontitis require a special approach when choosing a method of treatment, and the study of the influence of different methods of immobilization of lower jaw fragments on periodontal tissue and the development of complications of fractures in patients with severe periodontitis is an actual problem of dentistry [8, 15, 31].

In patients with mandibular fractures in combination with inflammatory periodontal diseases, the latter affect the course of the post-traumatic period of fractures and are one of the factors for the development of purulent-inflammatory complications [2, 6]. An important role in the occurrence of inflammatory complications is played by infection of the mandible fracture zone by pathogenic microflora of the oral cavity, odontogenic and stomatogenic pathological foci, since most of the mandibular fractures are open 67-82%, due to which they are likely to be infected [3, 20, 21]. The situation is aggravated by the presence of maxillary fixation, under which conditions the effectiveness of traditional means of oral hygiene is sharply reduced. In studies Yerokina confirmed that, in patients with inflammatory periodontal diseases with mandibular fractures, a direct strong correlation is determined between the severity of periodontal disease and the incidence

of purulent-infectious complications of fractures. In addition to traditional methods, she proposed a scheme for the treatment of patients with inflammatory periodontal diseases in mandibular fractures, including a complex of physiotherapeutic procedures consisting of dynamic magnetic therapy and percutaneous electrostimulation, treatment of periodontal pockets with cycloferon liniment and intramuscular administration of Traumel-C [5].

Periodontal and hygienic condition in treatment by different methods

Numerous authors studied the effects of various methods of immobilization of mandible fragments on periodontal tissue and on the development of fracture complications. It was suggested to abandon the use of dental splints in favor of alternative methods of immobilization of the lower jaw or the operative method of treatment without immobilization of jaws [1, 4]. In Kutsenko R.V.'s (2012) studies as operational methods of treatment were used methods of osteosynthesis using super-elastic structures of titanium nickelide with shape memory. The use of stable osteosynthesis using mini-brackets from titanium nickelide made it possible to exclude temporary immobilization of the lower jaw, and, as a result, to protect the health of the marginal periodontal tissue [9].

There is evidence that in jaw fractures, immobilization was carried out using orthodontic arc and braces [27-30]. From the point of view of the authors, this method is less traumatic on periodontal tissue and has been noted good oral hygiene compared with patients whose immobilized by Tigerstedt's or Erich's splints. Yamada and others proposed to use braces for the protection of soft tissues and additionally individually made molded splints in the region of the side teeth for strong fixation of the jaws [28].

Chandan *et al.* modified the arcuate rod and attached it to the dental arches using a light-cured composite material, fixation was performed without circumferential wires [25, 37, 40]. Another single maxillary fixation method is fixation using the Leonard's button which, according to the authors, is reliable method of intraoperative maxillary fixation in bilateral mandibular fractures. In addition, the Leonard's buttons can be fixed faster than splints and can provide improved oral hygiene compared with cross-linking. The Leonard's buttons fix to the tooth with steel wires, as in splinting [33]. Like the Leonard's buttons, Dimac's wires are set only in the premolar and molar areas, which also featured better oral hygiene. In this study also reported the advantage of less traumatism, without anesthesia, and in a short time to perform the imposition of the proposed method [35]. In addition, there is information about transalveolar maxillary fixation with severe periodontitis or insufficient teeth with a fracture of the jaw [42]. In the literature there are single data on the methods of immobilization of the lower jaw with the help of structures not fixed on the tooth rows (V-shaped, unified hooks, screws) [9]. In order to achieve interdental stabilization have been proposed composite splints made from an embrasure, Kevlar, fiberglass or wire, since they provide varying degrees of physiological micro movements that promote periodontal healing [26, 32, 34, 39].

The method of immobilization of the lower jaw also includes a method of semi-rigid fixation, in which the immobility was provided by a system of fixed orthodontic screws and rubber rods. In Yuan Yi (2010), Zhang Yi (2012), Lyapina's and other authors studies, in patients with a jaw fracture the fixation of the jaws was performed using mini orthodontic implants, and there was an improvement in hygiene, an

increase in the quality of life compared to patients who were immobilized with arch bars. [9, 8, 13, 15-17]. Despite the positive results of treatment with this method, it should be noted the following negative factors that are a direct consequence of the implantation of titanium mini-screws. Firstly, the screw implantation procedure is associated with the risk of injury to the root parts of the teeth that are in close proximity to the implant. Such injuries led to the occurrence of periodontitis, which were transient; in rare cases, due to the occurrence of acute retrograde pulpitis was required endodontic treatment. Secondly, local complications directly related to the trauma of the oral mucosa cause the occurrence of traumatic pyogenic granulomas and pressure sores at the site of contact of rubber traction with soft tissues [9, 17].

According to many foreign authors, the surgical method of treatment (osteosynthesis), the bonding of fragments using mini-screws, mini plates without the use of immobilization of the jaw is defined as the most rational method. [1, 4, 6, 7, 24, 43, 44]. In such cases, there was no negative impact on the periodontal tissue and relatively better nutritional status of patients. The use of titanium mini-plates provides a strong bond of fragments, which makes it possible to apply this method without additional use of orthopedic methods [1, 6, 44]. Gafarov found that the indicators of quality of life in the dynamics of the study depend on the method of treatment (surgical or surgical combination with orthopedic), the most optimal is "surgical osteosynthesis", which allows to fully restore the lost functions [4, 7]. The main disadvantages of an open focal osteosynthesis are the need for periosteal detachment, which is an important source of blood supply to the jaws, as well as an operation under general anesthesia, which requires preoperative preparation of various duration, the preciousness of the method, the need for repeated surgical intervention to remove osteosynthetic material, prolonged hospitalization of the patient [43, 44]. Despite the widespread use of various methods of treatment, the percentage of inflammatory complications of mandibular fractures remains quite high (11.5-15%) [5, 6, 16, 20]. Was noted more frequent development of inflammatory complications in patients after surgical methods of treatment in mandibular fractures [8, 24, 43]. Contrary to this, some scientists have confirmed that inflammatory complications are much less common in surgical treatment of the mandible than with conservative treatment [6, 7, 44]. Moreno *et al.* noted that treatment methods do not affect to the frequency of complications, the severity of the fracture and other factors provoke complications of inflammatory genesis [2, 23, 45].

However, these methods are not widely used and the main method of immobilization of fragments in lower jaw fractures remains the most affordable method, two-jaw splinting in many countries, as in our Republic.

The role of oral hygiene

Despite which treatment method was chosen, oral hygiene is of great importance for the prevention of inflammatory complications in the treatment of patients with mandibular fractures. With two-jaw fixation, the beneficial effect of good, high-quality individual hygiene and oral cavity care on the course of healing processes of jaw fractures, as it not only helps to eliminate soft plaque and food debris from teeth, gums and splinting structures, rubber bands, ligature wires, but and prevents the development of opportunistic infection, which leads to more rapid and easier healing of soft tissues (if they are damaged) and synostosis of jaw bone fragments [11, 18, 31, 38].

Medical treatment of the oral cavity consists in thorough cleaning of the splints and teeth from food debris by irrigation and washing the vestibular part of mouth with antiseptic solutions. After washing, the splints are cleaned from food debris stuck between the splint, teeth, gums, ligatures and rubber rings. During dressings, it is necessary to control the position of the splint, hooks, the condition of the wire ligatures. If there are bedsores from hooks on the mucous membrane of the lips, gums or cheeks, they must be bent to the appropriate position. Weakened ligatures twist and bend to the teeth [12, 41]. Individual hygiene is carried out not only after each meal, but also between food and before bedtime. Even if the patient is unconscious, it is necessary to wipe the teeth and mucous membrane of the mouth at least twice a day. Forming the right brushing skills improves hygiene efficiency, however, according to the data, there is still plaque on the oral surface due to the inability to brush teeth because of jaw splints. Hygienic treatment of the oral cavity with rinse solutions does not eliminate the negative situation, but only slightly reduces its activity [5, 11, 12, 18]. For this purpose, various antiseptics are used - a solution of furacilin, ethacridine, potassium permanganate, triclosan, octenisept, miramistin chlorhexidine (Eludril, Amident) 3% hydrogen peroxide solution, benzdiamine (Tantum Verde, Loroben) and others. In the literature there is information about the use of 6% solution of apple cider vinegar, which helps to remove plaque on the teeth and reduce its cariogenicity by desorbing carbohydrates from the surface of tooth enamel, oral mucosa and splinting structures [10].

The use of commercial ready-made antiseptic rinses for this purpose significantly improves oral hygiene. The rinse is an additional means for oral hygiene, which is an aqueous solution of active ingredients with certain therapeutic and prophylactic properties. An antiseptic based rinse (chlorhexidine, triclosan, benzydamine, methyl salicylate, cetylpyridine chloride (Lacalut, Asepta, Listerine, Parodontax, Glister) can be used for up to 14 days (in case of urgent need, it is possible to use an antiseptic solution for 21 days). Opolis can be used for up to 14 days (in case of urgent need, an antiseptic solution is allowed for 21 days). Rinsers based on plant extracts ("Lesnoy balzam", Splat, President, Mexidont) can be used regularly, they significantly reduce the risk of gum disease and periodontal disease. As the self-cleaning process of the mouth is disturbed during the splinting period, it is necessary to thoroughly rinse or irrigate the mouth at least 8-10 times a day [12, 18].

The use of antiseptics and liniments during immobilization and after removing the splints helps to eliminate the foci of inflammation and restore the structural and functional properties of the elements of the periodontal complex, which worsened due to wearing of splints. It is recommended, if necessary, to be observed by a periodontist patients with mandibular fractures, which were treated by intermaxillary fixation. [7, 11, 23].

It should be borne in mind that without the appropriate skills and patience of the patients themselves, it is not possible to achieve good oral hygiene and that the outcome of the underlying disease will depend on the level of hygiene culture and the quality of its performing.

Conclusions

Despite what method of immobilization of fragments was chosen, the primary surgical treatment of bone wounds and the rehabilitation of the oral cavity are fundamental factors for the successful treatment of patients with mandibular fractures.

It is necessary to observe the clinical picture of oral and periodontal hygiene in the dynamics of treatment in patients with fractures of the lower jaw. In the period of immobilization, along with the main treatment, attention should be paid to conducting a complex of measures in order to improve oral hygiene and prevent the progression of inflammatory and destructive changes in periodontal tissues in patients with periodontal inflammatory diseases in combination with jaw fractures.

Clinical significance: The high prognostic significance of the periodontal status of these patients explains the need for timely and accurate diagnosis of this condition. Comprehensive care for the oral cavity prevents the progression of destructive processes in periodontal tissues and reduces the risk of complications and creates optimal conditions for a favorable outcome of mandible fractures in patients during the treatment.

Conflicts of interest: The authors declare that they have no conflict of interest.

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