World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-46 May 2025
ISSN: 2749-3644

STUDY OF PERIODONTAL MICROCIRCULATION IN PATIENTS WITH JAW ALVEOLAR PROCESS FRACTURES USING VARIOUS IMMOBILIZATION METHODS

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Article history:

Received: March 28th 2025
Accepted: April 26th 2025

Abstract:

The article presents the results of periodontal microcirculation assessment during the immobilization period in patients with alveolar process fractures of the jaws. During immobilization, along with the main treatment, attention should be paid to implementing a set of measures that improve microcirculation indicators and prevent the progression of inflammatory-destructive changes in the periodontal tissues of patients with jaw alveolar process fractures.

Keywords: Jaw alveolar process fractures, maxillofacial trauma, jaw immobilization, periodontium, microcirculation.

RELEVANCE. Facial skeleton fractures account for 3.2%-5.8% of the total number of injuries [5,6,8]. The majority of facial bone injuries are jaw fractures, with 77.0% to 90.0% of patients seeking treatment in specialized medical institutions [1,4,8,11,13]. Given the increasing incidence of maxillofacial trauma, the issue of providing comprehensive specialized care for jaw alveolar process fractures (JAPF) remains relevant. Treatment of this patient category is carried out using both conservative (orthopedic) and surgical methods; often, a combination of these two main types of specialized treatment is employed. Despite improvements in mandibular fracture treatment methods, infectious and inflammatory complications frequently occur in the post-traumatic period. The development of these complications depends on several factors, including the presence of teeth with pathological processes in the periodontal tissues. Significant factors contributing to the development of complications include the body's resistance state, impaired blood circulation, and innervation in the fracture zone [1,3,9].

Currently, among the treatment methods for JAPF, the most widely used is the immobilization of fragments using smooth dental splints. When splints are applied, it becomes difficult to perform professional and individual oral hygiene. With prolonged immobilization, the hygienic condition of the oral cavity deteriorates. Dental plaque microorganisms are the direct cause of inflammatory processes in the periodontium. Normally, resistance mechanisms counteract microorganisms, but as soon as they overcome this defense at any point, an infectious process develops with tissue damage. Prolonged presence of bronze-aluminum ligatures in the cervical region of the teeth also leads to the development of an inflammatory process in the periodontal tissues, resulting in periodontitis - in fact, one of the experimental models for inducing periodontitis involves applying a ligature to the tooth's cervical area. In periodontal diseases, the application of dental splints leads to an exacerbation of periodontitis, which complicates the course of the disease, and in some cases, it is impossible to apply splinting structures [2,4,6-10].

There is no data in the literature on the influence of dental splints on the condition of periodontal tissues in patients with mandibular alveolar process fractures. Many authors propose abandoning the use of dental splints in favor of alternative methods for immobilizing alveolar bone fragments [5,11-13]. However, these methods have not gained widespread acceptance, and dental splints remain the primary method of fracture immobilization in mandibular alveolar process fractures, though their impact on patients' periodontal tissues has not been studied.

PURPOSE OF THE STUDY. To examine the influence of dental splints used to treat mandibular alveolar process fractures on the state of periodontal tissue microcirculation.

MATERIALS AND METHODS. The work is based on the experience of treating 65 patients with alveolar process fractures of the jaws. All patients with mandibular alveolar process fractures were divided into the following groups depending on the treatment method:

Group 1 - 20 patients used smooth dental arch bars for immobilization; Group 2 - 22 patients used smooth dental arch bars for immobilization with the application of "Medical Herbs" (Splat) mouthwash and CALCIY TRIACTIVE® D3; Group 3 - 23 patients used dental splints fixed with composite filling materials for immobilization.

Examination of patients with jaw alveolar process fractures (JAPF) and the control group was conducted 3 times during the course of treatment: before immobilization (upon admission to the

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department), on the 14th day of immobilization, and on the day of removal of immobilizing structures.

Studies of periodontal tissue microcirculation indicators using laser Doppler flowmetry (LDF) have been conducted in individuals with intact periodontium, where LDF indicators vary depending on functional state and age (Davidyan O.M., Davreshyan G.K., Kodzhakova F.R. et al.; 2020). Therefore, for an accurate comparative assessment, we studied the microcirculation of periodontal tissues in 16 healthy individuals of corresponding age groups and used their data for comparison.

For diagnosing the state of microcirculation during the study, we used laser radiation to probe the surface tissues of the periodontal complex. The processing of the laser radiation reflected from the tissue is based on isolating the Doppler shift from the recorded laser signal, where the oscillation frequencies of the reflected signal are proportional to the velocity of erythrocytes.

We studied indicators such as microcirculation index (MI), which represents the effectiveness of LDF with its values, as well as the complete diagnostic characteristics of surface basal perfusion, including the standard deviation and coefficient of variation of results.

RESEARCH RESULTS.

In the process of analyzing LDF-grams in healthy individuals with a healthy periodontal complex, the following indicators of capillary perfusion were established: PM averaged 11.84±1.26 conventional units, as shown in Table 1.

The microcirculation index of periodontal complex tissues decreased during treatment in patients with JAPF and amounted to 7.62±1.11 conventional units. The PM values obtained during the studies also indicate that patients aged 18-22 years, compared to other age groups, showed more active microcirculation in both healthy individuals of the control group and patients with JAPF ($p<0.05$).

The results of the standard deviation indicator in individuals with a healthy intact periodontal complex were 1.04±0.06 conventional units. The results of the standard deviation indicator in patients with JAPF showed a tendency to decrease before the start of fragment immobilization and demonstrated the following values: the standard deviation was 0.89±0.06 conventional units. In patients with JAPF, these low values were statistically significant ($p<0.05$). The standard deviation parameter characterizes the variable perfusion of blood circulation in the microcirculatory bed of periodontal complex tissues and, in particular, indicates a decrease in LDF values when studying average modulation across all frequency ranges of capillary blood flow.

Table 1

Periodontal microcirculation indicators according to LDF data in healthy individuals and patients with JAPF before immobilization (M±m) (n=81)

Groups	Microcirculation index, units	Standard deviation, units	Coefficient of variation, relative units	Microcirculation efficiency, units
Control group	11.84±1.26	1.04±0.06	6.95±0.41	1.39±0.02
Patients with JAPF	7.62±1.11	0.89±0.06	8.75±0.38	1.13±0.04

The coefficient of variation (Kv) in LDF studies of periodontal complex tissues in the examined groups reflects the general dependence of tissue perfusion on blood flow modulation, and according to our observations, the values of this indicator were highest in patients with JAPF. Vasomotor activity of microvessels in the healthy group showed the following values: 6.95%±0.41 relative units, while in the group of

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patients with JAPF - 8.75%±0.38 relative units, respectively, by age groups (p<0.05).

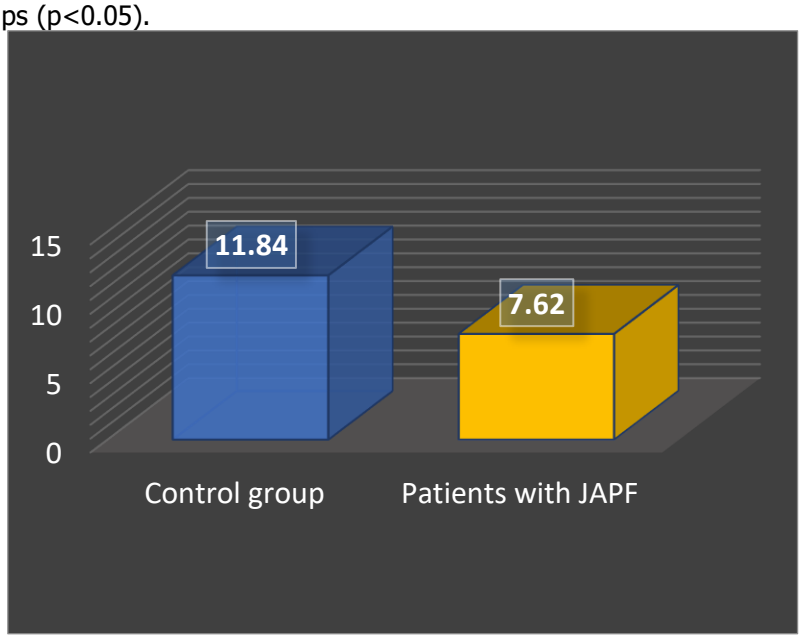

Diagram 1. Periodontal microcirculation indicator according to LDF data in the control group and patients with JAPF before immobilization (M±m) (n=81)

The dynamics of changes in periodontal complex tissue microcirculation indicators according to LDF data during various immobilization methods on the 14th and last day of JAPF treatment in patients of different groups are presented in Diagram 2.

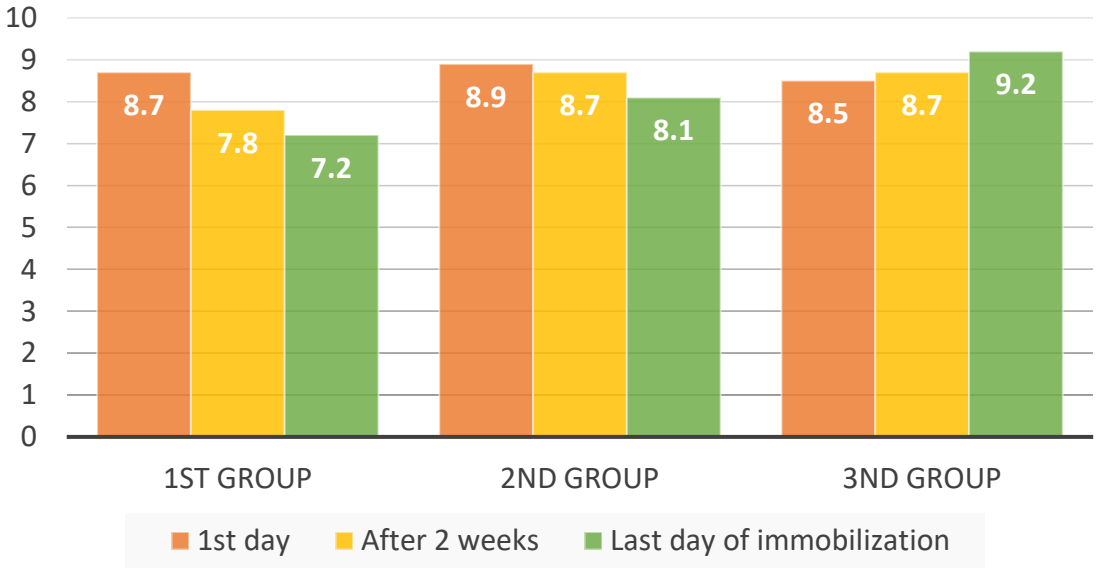

Diagram 2. Dynamics of periodontal microcirculation indicators according to LDF data in patients with JAPF during treatment with various immobilization methods

Analysis of the data obtained using LDF studies in the control group showed the following: PM - 11.84±1.26 arbitrary units. When comparing the PM of periodontal tissues in patients with JAPF, obtained before immobilization, with the parameters obtained from the control group, significant changes were revealed, indicating that in patients with JAPF, the state of microcirculation in periodontal tissues in the fracture area is disrupted, and in patients with JAPF it was 7.62±1.11 arbitrary units. The values obtained during LDF studies indicate more active microcirculation in the periodontal tissues of patients aged 18-22 compared to other age groups of healthy individuals and patients (p<0.05). During the study, cases were recorded where

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microcirculation efficiency indicators in patients with JAPF deteriorated by 1.2 times compared to the control group.

CONCLUSION. Analysis of the obtained results allows us to recommend the use of an oral hygiene regimen using the "Medical Herbs" (Splat) mouthwash and CALCIY TRIACTIVE® D3 in patients with JAPF. This regimen leads to an improvement in microcirculation indicators in patients with JAPF during immobilization using smooth bracket splints.

Thus, it can be concluded that when using immobilization methods that help preserve the anatomical and functional integrity of the periodontal complex tissues, the state of microcirculation in these tissues improves, which, in turn, affects the quality and speed of fragment consolidation during the treatment of fractures of the alveolar process of the upper jaw.

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