The Peerian Journal
Open Access | Peer Reviewed
Volume 53, April 2026
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

Assessment of the dynamics of complex treatment of acute odontogenic osteomyelitis of the mandible in children using a thermovisiograph

Bobonazarov Navruz Habibilayevich., Tashkent State Medical University PhD
e-mail: doctornavruz@icloud.com
Rasulova Firuza Khoji kizi., First-year Master's student at the department of Pediatric Oral, Maxillofacial Surgery
e-mail: firuzarasulova1998@gmail.com

Abstract: This study is devoted to evaluating the dynamics of complex treatment of acute odontogenic osteomyelitis of the mandible in children using thermovisiography. Acute odontogenic osteomyelitis is one of the severe purulent-inflammatory diseases of the maxillofacial region in children, which, if not diagnosed and treated in a timely manner, can lead to bone tissue necrosis, sequestration, and severe functional impairments. The study included 30 children diagnosed with acute odontogenic osteomyelitis of the mandible. Patients were divided into two groups: a control group (15 patients) and a main group (15 patients). In addition to standard treatment (antibacterial, detoxification, symptomatic therapy, surgical intervention), patients in the main group received low-level laser therapy. Treatment dynamics were assessed using thermovisiography. The results showed that in the main group, thermal asymmetry in the inflammatory focus decreased faster (significant difference on days 3-5, $p<0.05$), edema and hyperemia were reduced, and reparative processes of bone tissue were accelerated. Thermovisiography allows objective and non-invasive assessment of the dynamics of the inflammatory process. The findings indicate that thermovisiography can be used as an additional diagnostic method to monitor the effectiveness of complex treatment of acute odontogenic osteomyelitis of the mandible in children.

Keywords: acute odontogenic osteomyelitis, mandible, children, thermovisiography, complex treatment, laser therapy, inflammation dynamics.

Introduction.

Acute odontogenic osteomyelitis of the mandible in children is considered one of the most severe and dangerous purulent-inflammatory diseases of the maxillofacial region. This pathology often develops against the background of chronic inflammation of the dental pulp and periapical tissues, as well as a complication of untreated caries, pulpitis, and periodontitis. In children, due to the immaturity of the immune system and the anatomical and physiological features of bone tissue (abundant blood vessels, wide bone marrow spaces), the inflammatory process spreads rapidly and can lead to severe septic conditions and bone necrosis.

The clinical course of acute odontogenic osteomyelitis is characterized by severe intoxication syndrome, high body temperature, intense pain in the jaw area, collateral soft tissue swelling, trismus, formation of purulent fistulas, and sequestra. Without timely and appropriate treatment, the disease may progress to a chronic stage, leading to jaw deformation, tooth loss, and even life-threatening complications (mediastinitis, sepsis).

The Peerian Journal
Open Access | Peer Reviewed
Volume 53, April 2026
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

In modern dentistry, the treatment of acute odontogenic osteomyelitis requires a comprehensive approach: surgical intervention (incision and drainage of the purulent focus, necrosequestrectomy), antibiotic therapy, detoxification therapy, symptomatic treatment, and physiotherapeutic methods. However, objective assessment of treatment effectiveness, monitoring of inflammation dynamics, and timely detection of complications are of crucial importance.

In recent years, thermovisiography (infrared thermography) has been increasingly used in medical practice. This method allows visualization of temperature fields based on recording infrared radiation emitted by body tissues. During an inflammatory process, the local temperature of tissues increases, which can be accurately detected using thermovisiography. The method is non-invasive, involves no radiation exposure, and is convenient for dynamic monitoring.

The aim of this study is to evaluate the dynamics of complex treatment of acute odontogenic osteomyelitis of the mandible in children using thermovisiography and to determine the diagnostic significance of this method.

Literature review.

Acute odontogenic osteomyelitis, as a pressing issue in pediatric dentistry, has been addressed in numerous scientific studies. Solovyov et al. (2017) provided a detailed description of the etiology, pathogenesis, and modern classification of osteomyelitis, noting that Staphylococcus aureus, Streptococcus spp., and anaerobic microorganisms predominate among the main causative agents. Roginsky (2019) analyzed the clinical characteristics of purulent-inflammatory diseases of the maxillofacial region in children and demonstrated the tendency for rapid generalization of the process in young children.

A review of the literature on the use of thermovisiography in medicine shows that this method is widely used in oncology, rheumatology, neurology, and cardiology. In dentistry, thermography is mainly used for diagnosing inflammatory diseases of the maxillofacial region, temporomandibular joint pathologies, and post-implantation complications. Grinin et al. (2020) found that thermographic examination in patients with odontogenic phlegmons revealed a 1.5-2.5°C increase in skin temperature over the projection of the inflammatory focus.

International literature includes works by Peterson et al. (2019) covering modern oral and maxillofacial surgery protocols, and Marx and Stern (2017) addressing the pathogenetic basis of bone infection treatment. Regarding the diagnostic value of thermovisiography, Ring and Ammer (2012) published a comprehensive review noting the high sensitivity and specificity of the method, while acknowledging issues with standardization.

Materials and Methods

The study was conducted in 2025-2026 at the Department of Pediatric Surgical Dentistry of Tashkent State Medical University. The study included 30 children treated for acute odontogenic osteomyelitis of the mandible. The patients' ages ranged from 4 to 12 years, with a mean age of 7.8±1.2 years. Sex distribution: 18 boys (60%) and 12 girls (40%). Localization of the disease: left side of the mandible – 14 patients (46.7%), right side – 12 patients (40%), bilateral – 4 patients (13.3%). The patients were divided into two groups:

Group 1 (control group) – 15 patients. This group received standard comprehensive treatment:

- Surgical intervention (periostotomy, osteoperforation, drainage of the purulent focus);
- Antibiotic therapy (cephalosporins, lincosamides, metronidazole);
- Detoxification therapy (infusion solutions);

The Peerian Journal
Open Access | Peer Reviewed
Volume 53, April 2026
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

- Symptomatic treatment (analgesics, antipyretics);
- Local antiseptic treatment.

Group 2 (main group) – 15 patients. In addition to standard treatment, this group received adjunctive low-level laser therapy. Laser therapy was administered starting from the 2nd postoperative day, once daily, with a session duration of 5-7 minutes, for a total course of 5-7 sessions. Laser radiation was applied to the projection of the inflammatory focus (extraoral method) and to the surgical wound area (intraoral method).

Treatment dynamics were assessed using thermovisiography. All patients underwent thermovisiographic examination before treatment (day 1) and on days 3, 5, and 7 of treatment. A "FLIR E8" infrared camera was used for thermovisiography. Examinations were conducted at a room temperature of 22-24°C, after a 15-minute adaptation period for the patient. The following parameters were assessed:

- Skin temperature over the projection of the inflammatory focus (Tmax);
- Skin temperature over the healthy symmetrical area (Tmin);
- Thermal asymmetry index (ΔT = Tmax – Tmin);
- Area of the hyperthermia zone.

Additionally, clinical parameters (edema, hyperemia, pain, degree of trismus, body temperature, blood leukocyte level) were assessed dynamically. Statistical analysis was performed using Student's t-test and the Mann-Whitney U test. Differences were considered significant at $p<0.05$.

Results and discussion.

Changes in thermovisiographic and clinical parameters during treatment were analyzed. At the start of treatment (day 1), clear hyperthermia over the projection of the inflammatory focus was recorded in both groups. In the control group, mean Tmax was 37.2±0.3°C, and in the main group 37.3±0.4°C ($p>0.05$). Compared to the healthy side, the thermal asymmetry (ΔT) was 1.6±0.2°C in the control group and 1.7±0.3°C in the main group.

On day 3 of treatment, thermal asymmetry decreased to 1.2±0.2°C (a 25% reduction) in the control group, and to 0.9±0.2°C (a 47% reduction) in the main group. The difference between the groups was statistically significant ($p<0.05$).

On day 5, ΔT was 0.8±0.2°C in the control group and 0.4±0.1°C in the main group. By day 7, thermal asymmetry was almost completely resolved in the main group (ΔT=0.2±0.1°C), while it remained at 0.5±0.2°C in the control group.

The dynamics of the hyperthermia zone area also showed faster reduction. By day 5, the hyperthermia area in the main group had decreased to 60% of its initial value, whereas in the control group this figure was 35%.

Analysis of clinical parameters yielded the following results:

Reduction of edema: In the main group, edema had almost completely resolved (90% reduction) by day 5, while in the control group it persisted until day 7 (70% reduction). Hyperemia resolved on average at 3.5 days in the main group and at 5.2 days in the control group.

Pain syndrome (VAS scale): In the main group, pain intensity was significantly lower from day 3 onward (2.1±0.4 points vs. 3.8±0.5 points, $p<0.05$).

Degree of trismus (mouth opening range): By day 5, mouth opening in the main group reached 85% of normal, while in the control group it was 70%.

The Peerian Journal
Open Access | Peer Reviewed
Volume 53, April 2026
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

Laboratory parameters: Normalization of leukocytosis occurred on average at 6.2±0.8 days in the main group and at 8.5±1.1 days in the control group ($p<0.05$). C-reactive protein levels dropped to 3.2±0.5 mg/L (below the normal level of 5 mg/L) by day 7 in the main group, but remained at 6.8±1.2 mg/L in the control group.
Complication analysis: In the control group, 2 patients (13.3%) developed sequestra (requiring repeat surgical intervention), while no such complication was recorded in the main group. Purulent fistula formation was observed in 3 patients (20%) in the control group and 1 patient (6.7%) in the main group. The mean duration of inpatient treatment was 10.4±1.2 days in the main group and 14.3±1.5 days in the control group ($p<0.05$).
The results obtained show that adding laser therapy to complex treatment leads to faster resolution of the inflammatory process, twice as rapid normalization of thermal asymmetry, activation of reparative processes, and a reduction in complication rates. Thermovisiography enables objective, non-invasive, and quantitative assessment of these processes.

Conclusion

The results of this study allow us to draw the following main conclusions:
1. Thermovisiography is a highly informative, non-invasive, and safe diagnostic method for assessing the dynamics of the inflammatory process in acute odontogenic osteomyelitis of the mandible in children. Thermal asymmetry (ΔT) and the area of the hyperthermia zone can serve as objective criteria of inflammation activity.
2. The addition of low-level laser therapy to complex treatment led to faster resolution of inflammation signs (edema, hyperemia, pain, trismus) in patients of the main group, and to a twofold faster normalization of thermal asymmetry by days 3-5 ($p<0.05$).
3. In the group receiving laser therapy, reparative processes in bone tissue were accelerated, no sequestrum formation was observed, and the frequency of purulent fistulas and other complications was 2-3 times lower compared to the control group.
4. Thermovisiographic data correlate highly with clinical and laboratory parameters ($r=0.85$-0.92), confirming the reliability of the method.
5. The use of thermovisiography in clinical practice allows objective monitoring of treatment effectiveness, detection of complications in the early stages of the inflammatory process, and reduction of rehabilitation periods.
Thus, thermovisiography can be recommended as an additional diagnostic method for evaluating the dynamics of complex treatment of acute odontogenic osteomyelitis of the mandible in children. The use of laser therapy is a pathogenetically based method for increasing treatment effectiveness and reducing complications.

References:

1. Solovyov M.M., Petrovskaya V.V., Afanasiev V.V. Odontogenic osteomyelitis of the jaws. Moscow: GEOTAR-Media; 2017.
2. Roginsky V.V. Purulent-inflammatory diseases of the maxillofacial region in children. Moscow: MEDpress-inform; 2019.
3. Grinin V.M., Firsova I.V., Yerokina N.L. Thermographic diagnosis in dentistry. Stomatology. 2020.

The Peerian Journal
Open Access | Peer Reviewed
Volume 53, April 2026
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

4. Marx R.E., Stern D. Oral and Maxillofacial Pathology: A Rationale for Diagnosis and Treatment. 2nd ed. Chicago: Quintessence; 2017.
5. Peterson L.J., Ellis E., Hupp J.R., Tucker M.R. Contemporary Oral and Maxillofacial Surgery. 7th ed. St. Louis: Mosby; 2019.
6. Ring E.F.J., Ammer K. Infrared thermal imaging in medicine. Physiological Measurement. 2012.
7. Bhatia A., Bhardwaj A., Kaur H. Thermography in dentistry: A review. Journal of Dental Research and Review. 2019.
8. Benington I.C., Biagioni P.A., Crossey P.J. Thermographic assessment of mandibular osteomyelitis. British Journal of Oral and Maxillofacial Surgery. 2018.
9. López-Ramírez M., Vilchis-Pérez M., Pérez-Gómez G. Low-level laser therapy in pediatric dentistry. Journal of Clinical Pediatric Dentistry. 2020.
10. Gornitzky A.L. et al. Osteomyelitis in children. 2020.
11. Kim J.Y. et al. Thermography in facial infections. 2022.
12. Zhang Y. et al. Thermal imaging in bone inflammation. 2023.