Volume 4, Issue 2, February 2026 ISSN (E): 2938-3765

THE ROLE OF DIGITAL TECHNOLOGIES IN MONITORING THE EFFECTIVENESS OF ANTISEPTICS DURING THE REHABILITATION PERIOD AFTER JAW FRACTURES IN CHILDREN

Fazilova L. A.
Senior Lecturer, Tashkent State Medical University
e-mail: flutfinisa@gmail.com

Dusmuxamedov M. Z.,
Doctor of Medical Sciences, Professor,
Tashkent State Medical University

Adxamjonova G. A.
First-Year Master's Student, Faculty of Pediatric Surgical Dentistry,
Tashkent State Medical University
e-mail: adkhamjonova2002@gmail.com

Abstract
Evaluating the effectiveness of antiseptic agents during the rehabilitation period after mandibular fractures in children is of great importance in clinical practice. Due to the high risk of wound surface infection, the proper selection and monitoring of antiseptics directly affect the speed of rehabilitation and the likelihood of complications. In recent years, digital technologies have been widely used for monitoring wound conditions, analyzing the dynamics of tissue healing, and assessing the effectiveness of antiseptic application. This study investigated the clinical impact of antiseptic agents in the treatment process following mandibular fractures in children using digital diagnostic methods. Mobile applications, digital image analysis, and remote monitoring technologies were employed to evaluate tissue regeneration stages, changes in inflammatory signs, and the correctness of antiseptic selection. The results demonstrated that digital technologies provide accurate and rapid monitoring of antiseptic effectiveness, contributing to improved rehabilitation quality. The findings hold significant scientific and practical value in introducing innovative approaches to wound management in pediatric dentistry.

Keywords: Mandibular fractures in children, rehabilitation, antiseptic effectiveness, monitoring, digital technologies, wound infection, tissue regeneration, clinical assessment.

Introduction

In recent years, the incidence of maxillofacial injuries among children, including jaw bone fractures, has been increasing. The main causes include the growing number of motor vehicles, sports-related injuries, domestic trauma, and the anatomical and physiological characteristics of bone tissue during

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the growth period. Following jaw fractures in children, damage to facial tissues, alterations in the oral microflora, and a high risk of infectious complications are commonly observed. Therefore, proper assessment of antiseptic effectiveness and monitoring of their impact during the rehabilitation period are of great importance.

Modern digital technologies have penetrated all areas of medicine. Their application in dental practice enables clinicians to dynamically monitor patients' conditions, accurately evaluate the effectiveness of antiseptics, and develop individualized rehabilitation programs. In particular, digital monitoring systems allow rapid analysis of data regarding the effect of antiseptic agents on oral microflora, the degree of inflammation, and tissue regeneration status.

Literature Review

According to scientific sources, fractures of the maxillofacial region in children account for approximately 5–15% of all traumatic injuries (A. Karimov et al., 2021). Due to age-related characteristics of bone tissue—such as relative softness, increased periosteal thickness, and elasticity—fractures often present as incomplete, linear, or greenstick-type injuries.

Maintaining oral hygiene and selecting appropriate antiseptic agents are crucial during the rehabilitation stage. Among commonly used antiseptics in pediatric practice are Miramistin, Chlorhexidine, Furacilin, and Octenidine dihydrochloride. These agents differ in antimicrobial spectrum, tissue safety, and potential for allergic reactions, requiring careful medical supervision.

At this stage, digital monitoring systems—such as mobile applications, electronic medical records, digital photographic analysis, and artificial intelligence–based algorithms—enable real-time assessment of antiseptic effectiveness.

Materials and Methods

The study was conducted during 2023–2024 among children aged 6–14 years. A total of 40 patients who underwent conservative or surgical treatment for jaw fractures were included in the study.

The patients were divided into two groups:

- Group 1 (n=20): treated with 0.05% Chlorhexidine solution as an antiseptic.
- Group 2 (n=20): treated with Miramistin spray.

The rehabilitation period in both groups lasted 14 days.

For digital monitoring, daily intraoral photographs were taken using a mobile application. An artificial intelligence–based analytical algorithm was applied to assess the degree of inflammation, the area of gingival redness, and signs of exudation. Additionally, subjective patient data (pain, discomfort, changes in oral odor) were collected through digital questionnaires.

Results and Discussion

The obtained results demonstrated that digital analysis allowed a precise comparison of antiseptic effectiveness. In Group 2 (Miramistin-treated patients), inflammatory signs decreased by 65% by days 5–6, whereas in Group 1 the reduction was 45%.

By day 10, patients in Group 2 showed normalization of gingival color, reduction in pain syndrome, and accelerated epithelialization. When compared with traditional clinical observation records, the

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digital monitoring system demonstrated 20–25% higher diagnostic accuracy than subjective assessments.

These findings confirm the necessity of broader implementation of digital technologies in dental rehabilitation practice. Furthermore, mobile applications facilitated parental monitoring of children's oral hygiene practices, frequency of antiseptic application, and correctness of use.

Conclusion

1. Proper selection of antiseptic agents and monitoring their effectiveness during rehabilitation after jaw fractures in children are essential for preventing infectious complications.
2. Digital technologies, particularly mobile monitoring systems and artificial intelligence–based analytical algorithms, enable rapid, accurate, and objective evaluation of antiseptic effectiveness.
3. Miramistin is recommended as a well-tolerated and effective anti-inflammatory antiseptic agent for pediatric patients.
4. The widespread implementation of digital monitoring systems improves the quality of the rehabilitation period, simplifies medical supervision, and ensures an individualized approach to treatment.

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