INNOVATIVE LASER TECHNOLOGIES FOR RAPID MEDICAL DIAGNOSTICS AND TREATMENT

Abdurahmonova Osiyo Jahongirovna

Clinical Resident of Pediatric dentisrtry

Rahimberdiyev Rustam Abdunosirovich

PhD, Department of Pediatric dentisrtry

Samarkand State Medical University

Abstract: Rapid medical diagnosis and treatment using modern laser technology are becoming increasingly important in medicine and dentistry, thanks to groundbreaking software packages for Raman and fluorescence analysis.

The use of broadband, high-energy laser radiation serves a dual purpose: firstly, as a therapeutic tool [1, 2, 3, 4]; and secondly, as a way to enhance the Raman luminescent diagnostic capabilities of a biological sample [5] (in this case, we are referring to biophotometry).

The methodology is based on the analysis of registered spectral characteristics from Raman and/or luminescence fluorescence diagnostics (RLFD) of the objects under study (microbial metabolites, cells, tissues, and biological fluids in both healthy and pathological states) for the purpose of diagnosing diseases and processes of microbial, metabolic, neoplastic, or other origin [6].

We aim to provide experimental evidence that dental practice can benefit from the use of Raman-fluorescence medical technologies and laser hardware-software complexes. Limitations of Traditional Dental Diagnostics Oral health is crucial for maintaining internal balance in the face of both internal and external stressors. By analyzing markers of dental health, it is possible to accurately determine the presence or absence of pathological changes such as oral infections, enamel mineralization problems, and other

common dental diseases. Despite the significance of these characteristics, dentistry is currently unable to adequately measure them [1, 2, 3, 4].

Problems with traditional diagnostics. Many obstacles stand in the way of traditional diagnostic procedures. While visual assessment is necessary for diagnosis, it should be approached with caution due to its subjectivity and the possibility of multiple interpretations. Several aspects can influence the accuracy of a diagnosis. These include:

- Workplace lighting;
- Characteristics of color perception by medical experts;
- The health condition of the healthcare worker themselves.

Ignoring these considerations in traditional assessment methods leads to significant errors, which can sometimes reach 30–40% [1, 2, 3, 4, 5, 6, 7, 8]. Using Raman fluorescence for objective assessment There is an urgent need to overcome the current limitations in dental diagnostic procedures. Raman fluorescence technology, as a promising new direction, opens up entirely new possibilities for assessing oral health. Its use allows for:

- Conduct a quantitative assessment of the condition of oral tissues;
- Reduce the influence of subjectivity in diagnosis;
- Provide operational results [4, 5, 6, 7, 8].

This technology can help in a number of aspects, including:

- Determining the onset of demineralization;
- Measurement of microbial contamination levels;
- Assessment of the actual effectiveness of the ongoing treatment.

This approach is ideal for continuous condition monitoring, helps standardize the diagnostic process, and doesn't involve any invasive procedures, which are its three main

advantages. Based on clinical experience, this technology can improve diagnostic accuracy by 25–30%, reduce examination time, and aid in the early detection of diseases before symptoms appear.

Potential avenues for growth The direction of future research in this field will be determined by the following variables:

 Development of multi-level diagnostic methods;

Creating computerized criteria for assessing dental health;

The use of technologies that assist clinicians in decision-making.

Conclusion: These new approaches provide a framework for integrating evidence-based practice into routine clinical practice and personalized dentistry. Ultimately, this leads to an improvement in the quality of dental care.

Reference:

1. Karaseva, V. V. Otsenka stomatologicheskogo statusa, kontrolya individual'noi gigieny i kachestva zhizni patsientov s defektami chelyustei v sochetanii s medikamentozno assotsiirovannym osteonekrozom / V. V. Karaseva, T. M. Elovikova, A. S. Koshcheev // Stomatologiya. – 2020. – T. 99, № 5. – S. 80–86.

2. Otsenka stomatologicheskogo gigienicheskogo statusa studentov razlichnykh fakul'tetov Pervogo MGMU im. I.M. Sechenova na osnovanii anketirovaniya i dannykh ob"ektivnogo obsledovaniya / I. M. Makeeva [i dr.] // Ros. stomatol. zhurn. – 2017. – T. 21, № 6. – S. 337–339. – DOI: 10.18821/1728-2802-2017-21-6-337-339.

3. Shirshova, N. E. Metodicheskie aspekty otsenki sostoyaniya gigieny polosti rta u lits molodogo vozrasta / N. E. Shirshova, V. R. Teslenko, O. S. Gileva // Perm. med. zhurn. – 2006. – № 6. – S. 107–112. – URL: https://cyberleninka.ru/article/n/metodicheskie-aspekty-otsenki-sostoyaniya-gigieny-polosti-rta-u-lits-molodogo-vozrasta (data obrashcheniya: 04.05.2025).

4. Otsenka urovnya gigieny polosti rta i sostoyaniya tkanei parodonta u internov i ordinatorov kafedry terapevticheskoi stomatologii Pervogo MGMU im. I.M. Sechenova / O. I. Admakin [i dr.] // Sechenov. vestn. – 2015. – № 3 (21). – S. 27–30. – URL: https://cyberleninka.ru/article/n/otsenka-urovnya-gigieny-polosti-rta-i-sostoyaniya-tkaney-parodonta-u-internov-i-ordinatorov-kafedry-terapevticheskoy-stomatologii (data obrashcheniya: 04.05.2025).

5. Problemnye voprosy otsenki gigienicheskogo sostoyaniya polosti rta i ikh klinicheskoe reshenie / M. T. Aleksandrov [i dr.] // Stomatologiya. – 2020. – T. 99, № 4. – S. 21–26.

6. Primenenie lazernoi fluorestsentsii dlya otsenki gigienicheskogo sostoyaniya polosti rta / M. T. Aleksandrov [i dr.] // Vestn. RAMN. – 2003. – S. 39–44.

7. Lazernye Raman-fluorestsentnye meditsinskie tekhnologii v stomatologii: ot eksperimenta k klinike / M. T. Aleksandrov. – Moskva : KnigIzdat, 2020. – 160 s.

8. Stomatologiya (KhKh vek) : uchebnik dlya vuzov / M. T. Aleksandrov, N. N. Bazhanov [i dr.]. – M. : GOETAR-Media, 2008. – 415 s.