Laser-Based Innovations in Modern Medicine

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***Abstract*—Because of the emergence of medical imaging, laser technologies, biomedical optics, and artificial intelligence, tech -driven precision medicine has undergone significant evolution in the era. Since they allocate accurate, and minimal invasive medical solutions, medical practitioners use light -based equipment in diagnosis, therapy, surgery, and precision medicine globally. Physicians operate with the help of new methods like Computed Tomography(CT), Magnetic Resonance Imaging (MRI), Optical Coherence Tomography (OCT), and laser imaging and visualize internal organs and identify lots of illnesses at an early age of human beings. Techniques such as ophthalmology, dermatology, oncology, cardiology, and dentistry are worked for optical therapies e.g., photodynamic therapy, photobiomodulation, and laser surgery widely.**

How light -based technologies, lasers, and medical imaging are transforming modern healthcare is explained. Laser surgery, phototherapy, photodynamic therapy and AI-driven image analysis are highlighting the relevance of optical diagnosis in modern medicine and ensuring precision medicine and reduced invasive methods, revolutionizing cure consequences and patient healthy life in the world.

***Index Terms*—Medical Imaging, Precision Medicine, Artificial Intelligence, Laser Therapy, Photodynamic Therapy, Optical Diagnosis**

I. INTRODUCTION

Significant components of digitalised healthcare have been connected with medical imaging and light-based technologies. Through essential techniques like CT scan, MRI, and optical imaging, and laser surgery exact support in diagnosis and efficacious remedy. Image interpretation and disease identification are becoming effective enough with the recent innovation in both artificial intelligence and vast learning. Techniques globally such as dermatology, ophthalmology, oncology and surgery are utilized in the fields of light- based therapies and optical systems. All transformations help in minimally invasive treatments, decreasing unfavourable results and tributing in precision medicine with better treatments for all patients.

II. LITERATURE REVIEW

The evolution of ordinary tissue ablation to advanced intelligent, data-driven interventions emerged in the medical laser applications from 2024 to 2026. In the duration of 2025-26, developers mainly pay attention to Artificial Intelligence(AI) and Nanotechnology, whereas 2024 emphasized on increasing tool precision.

III. RESEARCH GAP

a. Highly standardized imaging and laser development become expensive.
b. Essential requirement for better advancement in AI models for disease detection problems.
c. Need for more engagement in imaging methods and real- time cures for humans.

IV. OBJECTIVES OF THE STUDY

a. To examine the impact of artificial intelligence and AI- driven tools in healthcare.
b. To propose a framework to integrate laser-based technology in modern medicine.
c. To analyse the effect of light in laser technology in the medical field.
d. How laser technology and AI- driven tools work together in better treatment.

V. HYPOTHESIS

1. H0 (Empty Hypothesis):
Cure, diagnosis, and surgery treatment are not worked with laser tools in the medical field well.

2. H1 (Other Hypothesis):
However, the integration of AI with laser devices provides better medical imaging, diagnosis , cure and surgery treatment.

VI. RESEARCH METHODOLOGY

Qualitative methodology is used in this study along numerous journals, books, articles, research papers which are published in laser-based technology, biomedical optics, medical imaging, and AI-driven tools in the modern field of medicine. Scientific journals, medical reports, and laser impact in modern medical science provide how to utilize the techniques of laser light application and innovation collected as a secondary data for the study .

VII. FINDINGS

- Laser-based technology is directly interconnected with medical science.
- Artificial Intelligence allocates better medical imaging and healthcare treatment.
- Light-based laser technology is now integrated with AI- driven tools in modern medicine.
- It improves our healthcare and better treatment for human lives.

VIII. RECOMMENDATIONS

- Integration of laser-based tools with artificial intelligence.
- Encourages better treatment with modern laser applications.
- Analyze impact of laser tools in modern medicine.
- Develop well maintained healthcare and remedy.

IX. CONCLUSION

Laser-based technology and artificial intelligence has revolutionised modern medical techniques and applications. With the innovation of medical imaging , MRI, CT scan and other essential laser tools developed the best treatment for human living . Complications like high costs , limited accuracy and accessibility directly concern AI for better methods and innovations in the medical field. It reveals the issues of disintegration of laser application with AI technology.

REFERENCES

[1] Topol, E.J. (2019). High-performance medicine: the convergence of human and artificial intelligence. Nature Medicine_25(1), 44-56.
[2] Huang, D., et al. (1991). Optical coherence tomography, Science_254(5035), 1178-1181.
[3] Jian, F, et al. (2017). Artificial Intelligence in healthcare: past, present and future. Stroke and Vascular Neurology_2(4), 230-243.
[4] Prasad, P.N. (2003). Introduction to Biophotonics. Wiley-Interscience.
[5] Alowais,S . A., et al. (2023). Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC Medical Education_23(1),689.
[6] Drexler, W., & Fujimoto , J.G.(2015). Optical Coherence Tomography: Technology and Applications. Springer.
[7] ICMR Guidelines (2023). Ethical Guidelines for Application of Artificial Intelligence in Biomedical Research and Healthcare. Indian Council of Medical Research, New Delhi.