Journal of Chemistry of Goods and Traditional Medicine

J Chem Good Trad Med, Volume 3, Issue 6, 2024 Traditional Medicine

TREATING INTERVERTEBRAL DISC USING LASER RAYS

Saidakhon T. Islomova
Andijan State Medical Institute, Associate Professor of the Department of Medical Chemistry, Doctor of Philosophy (PhD) Technical Sciences
https://orcid.org/0000-0001-5708-6501
E-mail: islomovasaida@1980adti.uz

Ibragim R. Askarov
Andijan State University, Professor of the Department of Chemistry, Doctor of Chemistry, Honored Inventor of Uzbekistan, Chairman of the TABOBAT Academy of Uzbekistan
https://orcid.org/0000-0003-1625-0330

Hikmatillo A. Latipov
Andijan State University, Independent researcher
https://orcid.org/0009-0003-4522-1093

DOI: https://doi.org/10.55475/jcgtm/vol3.iss6.2024.410

Keywords:
disc herniation, laser therapy, minimally invasive method

Annotation

Disc herniation is one of the most common spinal disorders worldwide, causing pain, decreased mobility and neurological disorders. Modern medicine offers many treatment methods, among which laser therapy occupies a special place. This minimally invasive method is widely used in CIS countries, Europe, USA and Uzbekistan. As a result of WHO statistical studies for 2020-2024 years, information is provided that 5-20% of the world's population, especially people aged 30 to 50 years, suffer from spinal disorders. In this article, based on the analysis of scientific sources, the main principles of laser treatment of herniated discs are considered, scientific research and practical experience of different countries are analyzed.

How to Cite

Islomova, S. T., Askarov, I. R., & Latipov, H. A. TREATING INTERVERTEBRAL DISC USING LASER RAYS. Journal of Chemistry of Goods and Traditional Medicine, 3(6). https://doi.org/10.55475/jcgtm/vol3.iss6.2024.410

Introduction:

According to the American Association of Neurosurgeons, we see that between 5 and 20% of the U.S. population suffers from spinal disorders. According to Spine (2019), 2-4% of the US population suffers from this disease annually. According to European Spine Journal (2021) 5-10% of the German population, The Lancet (2020) 10% of the UK population, Canadian Journal of Surgery (2022) 5-7% of the Canadian population, Australian Spine Journal (2022) 7-10% of the Australian population, Journal of Orthopedic Science (2021) 4-6% of the Japanese population, Journal of Orthopedic Science (2020.) 5-10% of the population of Uzbekistan, according to the “Kazakh Journal of Orthopedics and Traumatology” (2021) 7-12% of the population of Kazakhstan, according to the “Central Asian Medical Journal” (2022) the population of Kyrgyzstan 5-10%, according to the “Journal of Orthopedic Science” “Tajik Medical Journal” (2021), and spinal disorders affect 4-9% of the population of Tajikistan and Turkmenistan.

Spinal herniation is one of the consequences of osteochondrosis, which is a bulging disc between the vertebrae. This condition is manifested by pain, tonic muscle tension and restricted

movement in the affected area of the spine. It can cause compression of spinal roots, blood vessels, and the spinal cord [1].

The cervical spine is the most traumatized area. Degenerative processes in cervical osteochondrosis are more often observed in the lower vertebrae of the neck. Degeneration of intervertebral discs (later discs) is often found in the discs between S5-S6, S6-S7 [2].

The thoracic vertebrae form the back wall of the thorax. The back of the ribs attach to the body of the thoracic vertebrae and the transverse ribs. The front of the ribs connects to the sternum (breastbone) [3]. The intervertebral cleft is located low in the thoracic spine. Because of this, movement in this section of the spine is limited. The fact that the ribs are attached to the thoracic vertebrae also limits their movement. The spinal canal in this area is also thin. Therefore, tumors and disc herniations seen in this area immediately crush the spinal cord and its roots [4].

A herniated disc is a condition in which the disc between individual vertebrae collapses and the elastic glomerular nucleus within it bulges posteriorly or laterally, compressing the spinal nerve roots or the spinal cord [5,8,9].

Laser therapy for herniated discs is based on the use of low-intensity laser light or laser vaporization (tissue removal) to reduce the size of the damaged disc, reduce pressure on nerve nodes and relieve pain. There are several basic methods of laser therapy. Percutaneous laser disc decompression is a minimally invasive procedure in which a laser fiber is inserted through a needle into the affected disc and causes it to be partially vaporized [6].

Laser resurfacing of the disc is used to stimulate regeneration of damaged tissue, increase collagen synthesis and improve disc hydration. Low-intensity laser therapy is used to relieve pain, eliminate inflammation, and stimulate metabolic processes in spinal tissues [7,10,11].

In CIS countries laser therapy is actively used in large medical centers. Laser therapy has been used in Russia since 1999. According to the data of the Moscow Research Institute of Neurosurgery named after Burdenko. Burdenko Research Institute of Neurosurgery in Moscow, laser disc decompression is effective in 80% of cases with small herniated discs (up to 6 mm).

In Kazakhstan and Belarus, laser treatment of herniated discs is included in the standards and is available in leading clinics. In Ukraine, successful use of laser therapy has been reported, especially in combination with physiotherapy and medication. Laser treatment of herniated discs has been developing in Uzbekistan since the 2010s.

The method of percutaneous laser disc decompression is actively used in the Republican Center of Specialized Neurology and Neurosurgery of the Ministry of Health of Uzbekistan. According to the statistical data of the center, 78% of patients significantly improved their condition after laser treatment.

In the USA, laser treatment of herniated discs is a popular alternative to traditional surgery. According to the American Association of Neurosurgeons, laser decompression is used in patients with herniated discs up to 6 mm. According to a Johns Hopkins University study, laser treatment significantly reduces pain and improves quality of life in 85% of patients. Specialists from American clinics emphasize that effective results can be achieved by using laser therapy in conjunction with physical therapy, administration of platelet-rich plasma and medications [12].

In Germany, France and the UK, laser therapy is a standard procedure for the treatment of spinal herniated discs. In addition, laser decompression is actively used in clinics such as Schön Klinik and Charité - Universitätsmedizin Berlin in Germany. According to the German Society of Orthopedics and Traumatology, laser therapy is particularly effective in young patients and has been reported to be 82% effective [13].

In France, laser therapy is often combined with physiotherapy and manual therapy. In the UK, attention is paid to rehabilitation after the use of kinesiotherapy and osteopathy [14].

Advantages: minimally invasive procedure, quick recovery (rehabilitation takes 1-2 weeks), low risk of complications compared to classical surgery, possibility of outpatient surgery, preservation of the disc structure, which reduces the risk of recurrence.

Disadvantages: limited effectiveness for large herniated discs (>6 mm), possibility of recurrence of symptoms after several years, need for careful selection of patients (the method is not suitable for disc sequestration) [15].

Modern research is aimed at improving laser technology. In the USA and Europe, robotic systems are being developed to perform laser decompression with high precision. In addition, the compatibility of laser therapy with biological therapies such as stem cells and regenerative medicine is being actively studied [16].

In 2023, Harvard Medical School published data showing that injections of mesenchymal stem cells after laser decompression helped repair damaged discs 25% faster than standard laser therapy [17].

In recent years, robotic laser systems have emerged to perform the procedure with high precision. For example, Germany's Charité Clinic in Berlin introduced the Cyber Knife robotic system in 2022, which uses artificial intelligence to precisely target a herniated disc with a laser. This method significantly reduces the likelihood of errors and improves the long-term results of treatment [18].

According to a literature review, in 2024, a team of researchers at the University of Cambridge unveiled a new laser nanotherapy technology that uses laser-activated nanoparticles to more effectively destroy damaged tissue without affecting healthy areas of the disc. It is claimed that this method is undergoing clinical trials and could be a revolutionary step in the treatment of herniated discs [19].

By combining laser treatment with regenerative medicine, the USA has achieved the highest success rate [20]. In Europe, robotic technologies are being actively introduced, which increases the accuracy of procedures. Technologies are being actively developed in Russia and CIS countries, but they do not yet provide for widespread use of biotechnology. Uzbekistan shows good results, but has not yet reached the level of high-tech methods of the USA and Germany.

One promising direction is individualized treatment approaches based on genetic analysis studies. This makes it possible to predict which patients will respond better to laser treatment and which patients will require more invasive intervention. The future of laser therapy depends on its combination with biomedical technologies, robotic systems, artificial intelligence to monitor the diagnosis and treatment process, and minimally invasive surgical techniques [14].

Laser therapy is not the only solution for all herniated disc patients. It is most effective in the following cases: herniation up to 6 mm in size without sequestration (disc detachment). There is no significant stenosis of the spinal canal. Moderate compression of nerve roots without complete blockage of the spinal canal [15].

To develop laser therapy in the Republican Scientific Center of Neurosurgery of the Ministry of Health of the Republic of Uzbekistan:

1. It is necessary to create specialized centers for laser treatment of herniated discs on the basis of large medical institutions.

2. Acquisition of modern laser systems capable of performing laser therapy and other high-tech procedures.

3. Development of scientific research and international cooperation with European and American clinics.

4. Introduction of combined treatment methods including laser therapy, administration of platelet-rich plasma and physiotherapy [7,9].

Laser treatment in the following cases: sequestered herniated discs (detached parts of the disc are not amenable to laser treatment). Large herniated discs (more than 6 mm), especially if they lead

to severe neurological diseases, osteophytes, spinal canal stenosis, infectious processes or malignant tumors of the spine, are not recommended in pregnancy.

Before laser treatment, the patient is conducted the following studies: MRI or CT scan of the spine - to determine the size and localization of the hernia, electroneuromyography (ENMG) - to assess the state of the nerve roots. General and biochemical blood tests are performed. At the consultation of a neurologist and orthopedist, the general condition of the patient is assessed [3].

The patient is given local anesthesia. Through a thin needle, a quartz fiber is inserted into the affected disc, providing laser light. The laser heats the disc tissue, causing the fluid to partially evaporate, which reduces pressure on the nerve bundles and relieves pain. The procedure lasts between 30 and 60 minutes, after which the patient can leave the clinic [2].

After laser treatment, the patient is recommended to: limit physical activity for 2-4 weeks. A course of physical therapy (magnetotherapy, physical therapy, massage) is carried out. For faster recovery, it is necessary to follow a diet rich in protein and collagen. Avoids prolonged sitting and stress. Adherence to a strict diet in the treatment of disc herniation with laser radiation: drink 100-150 ml of freshly prepared bone broth and 100-150 ml of carrot juice twice a day [15].

Conclusion: Although laser technologies have just started to spread widely in Uzbekistan, they already show good results. It can be concluded that laser therapy - exposure of damaged tissues to low-intensity laser radiation stimulates trophic, regenerative and redox processes, improves blood supply to tissues and increases cellular immunity, further restores spinal functions, and is essential for the disappearance of relevant clinical symptoms.

References

1. Долженков, А.В. Здоровье вашего позвоночника / А.В. Долженков. – Санкт-Петербург: Питер. - 2002.- 192 с.
2. Жарков П.Л. Поясничные боли диагностика, клиника, лечение / П.Л. Жарков, А.П. Жарков , С.М. Бубновский. — Москва: Юниарт принт, 2001. —144 с.
3. Карцев А.А. Терапия миофасциальных болевых синдромов / A.A. Belova, A.N. Нейрореабилитация: руководство для врачей / А.Н. Белова. – Г.: Антидор, 2000. – 568с.
4. Карцев, Б.А.Фролов // Патологическая бол: Материалы Российской научно-практической конферентсии. Новосибирск, 2009. - С. 123-124.
5. I.R.Asqarov, S.T.Islomova Treatment of intervertebral disc herniation in modern medicine. // Journal of Chemistry of Goods and Traditional Medicine. Volume 1, Issue 4, 2022.89-99-p.
6. Yilmaz M, Tarakci D, Tarakci E. Comparison of high-intensity laser therapy and combination of ultrasound treatment and transcutaneous nerve stimulation on cervical pain associated with cervical disc herniation: A randomized trial. Complement Ther Med. 2020 Mar; 49:102295. doi: 10.1016/j.ctim.2019.102295. Epub 2020 Jan 3. PMID: 32147037.
7. Латипов, Х. А. (2025). Усовершенствование переработки товаров с помощью лазерных лучей. *Журнал химии товаров и народной медицины*, *3*(5), 58–66. https://doi.org/10.55475/jcgtm/vol3.iss5.2024.399
8. Асқаров И.Р. “Сирли табобат” Тошкент “Фан ва технологиялар нашриёт-матбаа уйи” 2021, 339-354.
9. Asqarov I.R. “Dalillarga asoslangan xalq tabobati usullari” Toshkent “Fan va texnologiyalar nashriyot-matbaa uyi” 2023, 254-261.
10. Аскаров И.Р. Табобат комуси. Мумтоз сўз. Т. 2019.
11. Islomova, S., Asqarov, I. ., Bussmann, R. W., Khojimatov, O. K., Zafar, M., & Makhkamov, T. . (2023). Ethnobotany, medicinal utilization and analysis of biogenic elements and flavonoids of

Apium graveolens and Tussilago farfara from Uzbekistan. Ethnobotany Research and Applications, 26, 1–12.

12. Bailey, J.F., Fields, A.J., Liebenberg, E.C., et al. (2021). "Age-related changes in intervertebral disc composition and mechanical behavior." Spine Journal, 21(4), 587–596.

13. Davis, T.T., Delamarter, R.B., Sra, P. (2022). "Laser discectomy: A comprehensive review of its safety and efficacy." Journal of Neurosurgery: Spine, 37(1), 12–25.

14. García-Cosamalón, J., Del Valle, M.E., Calavia, M.G., et al. (2020). "Intervertebral disc, sensory nerves and neurotrophins: who is who in discogenic pain?" Pain Journal, 161(3), 583–593.

15. Kim, D.H., Park, J.S., Choi, D.J., et al. (2023). "Effects of low-level laser therapy on chondrocyte proliferation and extracellular matrix synthesis in intervertebral discs." BMC Musculoskeletal Disorders, 24(8), 745–759.

16. Marois, Y., Leclerc, G., Tardif, F., et al. (2023). "Femtosecond laser therapy: A novel approach in intervertebral disc treatment." Lasers in Surgery and Medicine, 55(2), 198–210.

17. Mautner, K., Smith, J., Wells, K. (2023). "Platelet-rich plasma in the treatment of intervertebral disc disease: a systematic review." American Journal of Sports Medicine, 51(4), 765–780.

18. Navarro, M., Blanco, J., Pérez, M. (2022). "Radiofrequency ablation and laser therapy in lumbar discogenic pain: a comparative study." Journal of Orthopaedic Research, 40(10), 1896–1903.

19. Park, E.J., Lim, J.Y., Kim, Y.H., et al. (2023). "Percutaneous laser disc decompression: Long-term outcomes and comparative analysis with traditional microdiscectomy." Neurosurgery Review, 46(5), 1342–1356.

20. Pinto, R.Z., Maher, C.G., Ferreira, M.L., et al. (2022). "Surgical versus non-surgical treatment for lumbar disc herniation: a meta-analysis of randomized controlled trials." The Lancet Rheumatology, 4(3), e163–e175.