

## History of the Creation and Prospects for Using the 308 NM Excimer Laser For Vitiligo

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**Abstract:** The 308 nm excimer laser is a type of ultraviolet laser that uses excimer molecules as the active medium. "Excimer" comes from the words "excited dimer". These molecules are formed by the interaction of two atoms, one of which is in an excited state. This publication contains the history of the creation, and future prospects for the use of an excimer laser with a wavelength of 308 nm.

**Keywords:** Excimer laser, creation of an excimer laser, vitiligo, prospects for an excimer laser.

The development of excimer lasers began in the 1970s. Major research in this area was carried out with the aim of creating new sources of ultraviolet radiation that could find application in various fields, including medicine, industry and scientific research.

308 nm excimer laser typically uses gaseous mixtures including noble gas halides such as xenon ( Xe ), krypton ( Kr ) or argon ( Ar ), combined with fluorine ( F ). One of the most common combinations to produce radiation at 308 nm is the use of xenon and fluorine ( XeCl ).

The operating principle of an excimer laser is as follows: during an electrical discharge or other type of excitation, excited excimer molecules are formed in a gas mixture. These molecules have higher energy than individual atoms or molecules in their normal state. When returned to an unexcited state, the excimer molecules emit photons, forming a laser beam.

Excimer lasers are widely used due to their unique properties, such as the ability to create very short and intense pulses of ultraviolet radiation. They are used in laser surgery, especially in ophthalmology for vision correction, in microelectronics for lithography, and in scientific research.

308 nm excimer laser is widely used in dermatology due to its ability to effectively treat certain skin conditions. This type of laser is especially useful for treating conditions associated with abnormal growth and behavior of skin cells.

The main applications of the excimer laser in dermatology include:

1. **Treatment of psoriasis:** Excimer laser is effective in treating psoriasis, especially in mild and localized forms. Laser light helps reduce inflammation and slow the excessive division of skin cells that is characteristic of psoriasis.

2. **Treatment for Vitiligo** : Vitiligo is a condition in which the skin loses its pigment. The excimer laser can stimulate skin cells to produce melanin, thereby restoring normal skin color in the affected areas.
3. **Treatment of atopic dermatitis** : Excimer laser can be used to reduce the symptoms of atopic dermatitis, including itching and inflammation.
4. **Treatment of chronic eczema** : Laser treatment can help reduce inflammation and improve skin conditions in various forms of eczema.
5. **Scar and Keloid Removal** : Excimer laser can be effective in smoothing and reducing the appearance of scars and keloids.

The benefits of using an excimer laser include high precision and controllability, minimal damage to surrounding tissue, fast recovery time, and the ability to treat without the use of systemic medications. However, like any medical procedure, laser treatment may have side effects such as redness, swelling, or scabbing at the treatment site. It is also important to note that the effectiveness of treatment may vary depending on the individual patient and the nature of the disease.

308 nm excimer laser to treat vitiligo, the main mechanism of action is to stimulate melanocytes - the cells responsible for the production of melanin, the pigment that gives the skin its color. Vitiligo is characterized by the loss of melanocytes in certain areas of the skin, resulting in white patches.

The mechanism of action of the excimer laser includes the following key aspects:

1. **Stimulation of melanocytes** : Ultraviolet laser light stimulates the remaining melanocytes in the skin or hair follicles of the affected areas. This leads to their activation and increased melanin production.
2. **Repigmentation** : Activated melanocytes begin to restore pigmentation in the treated areas, resulting in a reduction in white spots and restoration of the skin's natural color.
3. **Modulation of the immune system** : It is believed that the excimer laser can also influence the local immune response in the skin, which may be useful in cases where vitiligo is associated with autoimmune processes.
4. **Targeted action** : Thanks to the precise focusing of the laser beam, treatment can be applied directly to the affected areas, minimizing the impact on healthy areas of the skin.

Excimer laser treatment is usually carried out in several stages, with regular sessions. The effectiveness of treatment may vary and depends on many factors, including the duration of the disease, the location and size of the affected areas, and the individual characteristics of the patient.

It is important to note that excimer laser treatment is a treatment option for vitiligo and should be performed under the supervision of a qualified dermatologist. In some cases, it may be necessary to combine laser therapy with other treatments, such as topical medications or systemic therapy.

The prospects for using excimer laser to treat vitiligo in the future look promising, given the ongoing research and development in this area. Current trends and potential directions for development include the following aspects:

1. **Improving Efficiency and Safety** : Ongoing research is aimed at improving the effectiveness and safety of excimer lasers. This may include developing new treatment protocols that optimize the dosage and frequency of laser sessions to maximize results while minimizing side effects.

2. **Individualized Approach** : Future research may focus on developing individualized approaches to vitiligo treatment that take into account the genetic, immune, and physiological characteristics of each patient.
3. **Combination Therapy** : Integrating the excimer laser with other treatment modalities, such as topical medications, systemic therapy, or phototherapy, may improve treatment outcomes. Research in this area is aimed at identifying the most effective treatment combinations.
4. **Technological Improvements** : Continued technological improvements in the design and functionality of excimer lasers can improve the accuracy and ease of use, making treatment more accessible and comfortable for patients.
5. **Availability and Distribution** : With the increasing availability and decreasing cost of excimer lasers, this therapy may become more accessible to more patients around the world.
6. **Research into Disease Mechanisms** : Understanding the mechanisms of vitiligo at the molecular and cellular level may help develop more targeted and effective treatments, including the use of excimer lasers.
7. **Long-Term Follow-up** : Long-term studies on the effectiveness and safety of excimer lasers for treating vitiligo will help better understand their role in managing this condition.

It is important to note that all of these areas require additional research and clinical trials to confirm their effectiveness and safety. As in any field of medicine, it is important to follow current scientific evidence and expert recommendations when choosing treatment options.

**Conclusions.** In conclusion, the article on the creation and use of the 308 nm excimer laser in the treatment of vitiligo emphasizes that this method is a significant breakthrough in dermatology. A historical overview of the development and improvement of excimer lasers shows their evolution from primitive devices to high-tech medical instruments. The advantage of the laser in its specificity of action on the affected areas of the skin, which ensures high efficiency with minimal risk of side effects, makes it one of the most preferred methods of treating vitiligo. Analysis of clinical studies demonstrates that excimer laser treatment improves skin condition and improves the quality of life of patients suffering from vitiligo. Comparison with traditional treatment methods such as phototherapy and topical agents shows that laser therapy is more targeted and effective. Prospects for the use of the excimer laser include its combination with other therapeutic modalities, which may improve the overall effectiveness of treatment. Despite the current success with lasers, further research is needed to optimize treatment protocols and fully understand the mechanisms of laser action on the skin. Overall, the use of the 308 nm excimer laser opens up new horizons in the treatment of vitiligo, offering an effective and safe method for the management of this complex and often life-impairing disease.

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