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## Technical Principles, and Development Prospects of Magnetic Resonance-Guided High-Intensity Focused Ultrasound Ablation, with innovative Waves-eliminate-shape (WES) method

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### Abstract

*There are several traditional methods for cancer treatment, including radiotherapy, targeted therapy, and biological agent therapy, among others. However, these therapies have never been able to completely eradicate cancer cells. They exert some effect on cancer cells but do not achieve complete elimination. For example, current targeted drugs can only temporarily inhibit the development of cancer cells but cannot sustain long-term suppression. Furthermore, prolonged use of these drugs often leads to resistance, rendering the therapies ineffective over time, which has consequently hindered improvements in the 5-year survival rate. Overall, the 5-year survival rate remains below 70%. The current situation is therefore less than ideal. As a result, this research article aims to explore new technologies, methods, and concepts that might enable the complete eradication of cancer cells. This research introduces the concept of resonance cancer elimination method (waves to eliminate shapes [WES]), which involves utilizing different wavelengths and resonance frequencies to precisely target and eradicate cancer cells. This approach aims to completely eliminate the source of cancer through the application of various resonance frequencies and wavelengths.*

**Keywords:** *Magnetic resonance-guided high-intensity focused ultrasound; thermal ablation; uterine fibroids; Waves-eliminate-shape (WES)*

### Introduction:

Recently, there are several traditional cancer treatment methods, including radiotherapy II, targeted therapy, biological agent therapy, etc. However, these therapies have never been able to completely eliminate cancer cells. They only have a certain effect on cancer cells but cannot completely eliminate cancer cells. For

example, the current targeted drugs can only inhibit the development of cancer cells temporarily, but cannot inhibit the development of cancer cells for a long time. Moreover, drugs will become resistant after being taken for a long time, and drug

resistance will appear. This will make the drug ineffective, so the 5-year survival rate has not been able to increase.

Moreover, the average 5-year survival rate will not exceed 70% overall [1]. In fact, the situation is not ideal. Therefore, this research aims to help completely eliminate cancer cells by exploring new technologies, methods, and concepts.

This research article proposes the concept of resonance cancer elimination (waves to eliminate shapes [WES]), which means that we hope to use different wavelengths and resonance frequencies to completely and accurately attack cancer cells. This extermination attack will completely eliminate the source of cancer cells through different resonance frequencies and different resonance wavelengths.

## Literature Review:

Magnetic resonance-guided focused ultrasound (MRgFUS) is an advanced minimally invasive technique combining image guidance and thermal ablation. It utilizes multiple beams of ultrasound energy focused on the target area, rapidly heating the local tissue and inducing coagulative necrosis. Simultaneously, magnetic resonance imaging provides real-time localization and temperature measurement, enhancing treatment precision and safety. MRgFUS is currently used for uterine fibroids, adenomyosis, bone lesions, and some functional neurological disorders, demonstrating advantages such as no incision, low complication rate, and rapid recovery. However, its widespread clinical application is still limited by equipment cost, indication selection, treatment time, and anatomical constraints. Ablation therapy is an important component of modern interventional medicine, primarily using heat, cold, electric fields, or other forms of energy to destroy lesion tissue to achieve therapeutic goals. Traditional ablation methods, such as radiofrequency and microwave ablation, often rely on punctures or catheters to enter the lesion. While effective, these methods also carry risks such as bleeding, infection, and damage to adjacent tissues. With advancements in imaging and energy delivery technologies, MRgFUS has gradually emerged as a treatment modality that combines high precision with low invasiveness [2]. The core advantages of MRgFUS depend in its "incisionless, real-time monitoring, and precise focusing" characteristics. Magnetic resonance imaging provides excellent soft tissue resolution and allows for monitoring of temperature changes during treatment via thermal imaging, concentrating treatment energy on the target area and reducing damage to normal tissues. In recent years, in addition to its application in benign gynecological tumors, this technology has gradually expanded to functional neurosurgical diseases, becoming an important emerging tool in precision medicine [3].

### Technical Principle

MRgFUS uses multiple high-intensity ultrasound beams focused at a specific focal point within the body, raising the temperature of the target area to a level sufficient to cause protein denaturation and cell necrosis, thereby achieving a local ablation effect. Unlike ordinary ultrasound, the focused energy creates a high energy density at the target site, while surrounding tissues are only affected by lower energy, thus exhibiting excellent selectivity [4]. Magnetic resonance imaging (MRI) plays a dual role in this technique: firstly, preoperative localization, assisting in determining the extent of the lesion and its relationship with adjacent important structures; secondly, real-time intraoperative temperature monitoring, allowing the operator to adjust energy

output and treatment pathway based on heat distribution. This closed-loop control mechanism significantly improves the accuracy and predictability of ablation [5].

### Clinical Applications

One of the most mature applications of MRgFUS is the treatment of uterine fibroids. Related literature indicates that MRgFUS can improve fibroid-related symptoms and reduce tumor size, with some patients experiencing a significant improvement in quality of life after treatment. For patients desiring fertility, MRgFUS is also considered a potentially worthwhile reproductive-sparing treatment, but its long-term impact on reproductive outcomes still requires further research [6]. In the field of functional neurosurgery, MRgFUS has been used to treat essential tremor and some symptoms of Parkinson's disease, demonstrating immediate and sustained symptom improvement. Related studies indicate that transcranial MRgFUS can reduce tremor or improve motor symptoms by precisely ablating specific areas of the thalamus or hypothalamus. Furthermore, clinical experience in Hong Kong also shows that this technique can serve as an alternative for patients who cannot tolerate craniotomy or whose symptoms are poorly controlled with medication [7]. In addition to gynecology and neurosurgery, MRgFUS is being explored for applications in bone and breast lesions, as well as other neoplastic diseases. The Peking Union Medical College Journal points out that this technology has received widespread attention and is considered an important research direction for next-generation thermal ablation [8].

### Advantages and Limitations

The greatest advantage of MRgFUS is its non-invasive nature and image-guided precision. Compared with traditional surgery, it requires no incision, usually no general anesthesia, and offers faster recovery, making it particularly attractive to elderly patients or those with multiple comorbidities. Because the treatment can be monitored in real time, it is easier to control risks and minimize damage to surrounding tissues [9]. However, this technology also has significant limitations. First, the equipment is expensive, and treatment requires a magnetic resonance imaging system and a specialized team, limiting its widespread adoption in general medical institutions. Second, the skull, gas, or other tissue structures may affect ultrasound transmission, making some lesions unsuitable for this therapy. Furthermore, long-term follow-up data are lacking for some neurosurgical applications, and the safety of bilateral and repeated treatments requires further investigation [10].

### Research status

Current research on MRgFUS focuses primarily on three aspects. First, evaluating its efficacy and safety in different diseases, particularly long-term outcomes in neurological and gynecological disorders. Second, optimizing imaging and thermal monitoring technologies to improve treatment efficiency and reduce side effects. Third, establishing more comprehensive patient screening and treatment guidelines to enhance clinical operability and cost-effectiveness. A systematic review revealed a close correlation between imaging features and treatment outcomes, particularly in stereotactic tremor and Parkinson's disease, where lesion location and brain network connectivity may influence treatment response. This suggests that future development of MRgFUS involves not only advancements in energy technology but also the establishment of personalized image interpretation and precise target selection strategies [11].

## Innovative Idea (Suggestion):

Use waves to create shapes, & use waves to eliminate shapes (WES)

This research proposes a novel therapeutic concept: using waves both to create and to eliminate biological structures, referred to as Waves-Eliminate-Shape (WES). The central idea is to apply wave-based energy to target and disrupt specific cellular shapes, particularly malignant cells, through a process termed “shape ablation.”

This innovative method focuses on the geometry of the cell nucleus as a primary target. By tuning specific wavelengths to correspond with the structural characteristics of cells, wave energy can be directed in a highly focused manner. Different wavelengths produce different vibration frequencies, and when these frequencies match the natural frequency of a cellular structure, resonance occurs.

This resonance-based approach aims to selectively disrupt malignant cells. When resonance frequencies align with the structural “shape signature” of tumor cells, the resulting vibrational energy may destabilize the cells, potentially leading to thermal effects such as localized heating. This process could weaken or break down malignant cells, possibly transforming them into a liquid-like state for easier elimination or reshaping.

A key advantage of this method is its precision. By concentrating energy at specific frequencies and locations, it may reduce damage to surrounding healthy tissue compared to conventional radiation therapies. The combined effect of internal (inside-out) and external (outside-in) wave interactions could further enhance resonance within tumor cells, improving treatment efficiency and focus.

In addition to wave-based ablation, this concept explores the potential of integrating advanced techniques such as MR-guided focused ultrasound (MRgFUS) for precise targeting. The idea of “neutrino ablation” is also proposed as a theoretical extension. Due to their extremely high penetration capability, neutrinos could, in principle, reach deep-seated tumors that are inaccessible to conventional methods such as microwave ablation.

Our concept highlights the importance of developing highly penetrative and precise energy-delivery systems. Such systems could allow treatment of tumors located more precisely, beyond the reach of existing surface-based or limited-penetration techniques.

Overall, our WES framework emphasizes resonance-driven, shape-targeted ablation as a future direction for more precise, focused, and potentially less harmful cancer treatments.

### Waves-eliminate-shape (WES)

Moreover, different wavelengths will produce different vibration frequencies, and these frequencies will produce effects called resonance. This is the resonance elimination method, where the bell shape is still in the wave elimination type. We will use different wavelengths to create different resonances. When the frequency generated by this resonance can cover the shape line of malignant cells (stem cells), the resonance frequency can melt the malignant cells. Heating to a liquid state may eliminate and reshape the tumor cells.

This innovative method concentrates the power of frequency on the tumor cell, including the tumor cell's vibration and the inside-out and outside-in frequency waves, causing a resonance frequency that may liquefy and melt the tumor cell through heat and

resonance. This reduces unnecessary radiation that may harm healthy cells and focuses the treatment on ablating malignant cells, making the power of treatment more focused, concentrated, and effective.

### Neutrino ablation with (MRgFUS)

Additionally, in terms of microwave resonance ablation, we can try neutrino ablation to utilize the physical properties of neutrinos as a more accurate and harmless way to eliminate malignant cells. Neutrinos are highly permeable and can penetrate places that microwaves cannot reach. This refers to a higher permeability that allows neutrinos to penetrate places that microwaves cannot. For example, in the past, microwave ablation could only ablate malignant cells on the surface. But it could not ablate malignant tumors in organs inside. If we can utilize the inherent properties of [neutrinos], we can penetrate deep into the enemy's position [malignant tumors]. Then, we can penetrate and reach malignant cells in places that previous microwave ablation techniques could not reach, and perform [neutrino] ablation.

## Conclusion:

Our innovative Waves-eliminate-shape (WES) method aims to modify the conventional (MRgFUS), which represents a new significant innovation shift to the method in conventional ablation therapy from invasive procedures to a more precise, more in-depth (image-guided), and incision-treatment. Our innovative method may show a significant potential in reality clinical results in uterine fibroids and functional neurological disorders in the near future. Much more, in the near future (WES) method may demonstrated considerable application potential. Overall, our innovative (WES) method is expected to play a more important role than the conventional MRgFUS in the future of precision medicine. Hope our innovative idea can contribute to the world and the mankind.

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