

MEDICAL DEVICE FOR THE NON- INVASIVE TREATMENT OF TUMORS USING SHEAR WAVES AND LIFU ULTRASOUNDS

Technology for Licensing

Keywords:

Shear waves, ultrasounds, mechanotransduction, medical device, LIFU, tumoral therapy, cancer, cancer stem cells (CSC).

Description:

In recent years, the search for new tumor treatments has been oriented through less invasive therapies. As result, the use of ultrasound-based medical devices to combat localized cancer is increasingly being promoted.

Currently, HIFU devices (High Intensity Focused Ultrasound) are used for heat ablation and tumor resection, some of which are commercially available as certain cancers treatment. LIFU devices (Low Intensity Focused Ultrasound) are experimentally used for some therapy: (i) sonodynamics; (ii) improve the chemotherapeutic agents delivery to a solid tumor; (iii) sonoporation; (iv) improve gene delivery or transfection, and (v) generate antivascular actions by tissue heating. However, such bio-effects can lead to additional healthy tissue damage.

For solving this, our portable device adheres to patients' surface and impacts the cellular behavior of cancer stem cells (CSCs) by application of shear waves and ultrasound at a controllable frequency. The effects generated are not attributed to thermal action, so nearby tissues are not affected. The direct impact on CSCs causes phenotype changes by inducing their cellular differentiation via mechanotransduction, promoting O₂ and nutrient permeability, and sonoporation. So, CSCs are prevented from entering a resting state that allows them to avoid treatment, escape the tumor and initiate metastatic process.

Unlike the other devices, this one favors the CSCs removal, which are responsible for tumor development, resistance, metastasis, and tumor recurrence.

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A portable medical device allows cancer stem cells treatment by shear waves and low frequency ultrasound (LIFU) application. Its adhesion to skin enables the focused transmission of shear waves to a target region. The final effect is the affection of the behavior of these tumor cells. In this way, it pretends to be a support for classical tumor therapy.

Advantages and Benefits

- » Less destruction of proximal healthy tissue
The ultrasound effects are not mainly attributable to thermal action non-specific cellular response.
- » Changes in the phenotype of CSCs
Through mechanotransduction, ultrasounds induce phenotypic changes on CSCs that favor tumor therapy.
- » Support for regular chemotherapy
The CSCs differentiation helps to sensitize them against the chemotherapeutic used to fight the tumor and face the treatment.
- » Reduce the possibility of tumor resistance, recurrence and metastasis
The CSCs differentiation and the entry into the cell cycle stimulates the exit of the quiescent state, thus preventing tumor evasion and the starting of the metastatic process.
- » Take away the tumor CSCs subpopulation
It is possible to control the frequency of the applied ultrasound to induce the CSCs death.
- » Useful for treating tumors in greater depth

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