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Review Article

RFQMR- The future of myofunctional appliance

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ABSTRACT

The review attempts to suggest the use of Rotational Field Quantum Magnetic Resonance (RFQMR) beams in the treatment of skeletal class II cases with retrognathic mandible. A systematic electronic search was conducted in databases such as Google Scholar and PubMed. The inclusion and exclusion criteria were listed out and those publications that did not meet one or more of the inclusion criteria were excluded. A total of 40 articles were selected by search strategies. Out of which 3 studies matched with the inclusion criteria. The results of the 3 included studies were analysed. This review reveals that this non-surgical and non-invasive therapy is a landmark treatment for osteoarthritis. Its usage in the treatment of skeletal class II has to be time tested and proven.

1. Introduction

Utilizing tissue engineering techniques, now it is possible to regenerate dying tissues and organs inside the body, re grow blood vessels, heal wounds or fix an adamant fracture, grow new cartilage or even death of malignant cells that have gone on a multiplication rampage.

A novel approach to modulating cell proliferation and apoptosis in living tissues is provided by Rotational Field Quantum Magnetic Resonance (RFQMR) beams/rays. The "Cytotron" is used to accomplish RFQMR (Figure 1). The cytotron looks like a modified magnetic resonance imaging equipment. The CYTOTRON-RTE-6040-864GEN is a patented, CE-marked device (U.S. Patent 9162076 B2 given 20/10 2015; European Patent EP 175350831, awarded 3/11/2015; Chinese Patent issued 2010, 09/08). It was created by Scalene Cybernetics Ltd in Bengaluru, India. In degenerative disorders like arthritis, this customized MRI equipment may aid in cartilage regeneration. It may also kill cancer cells in several different cancers. The machine features a plethora of cannons arranged along 9 axes (designated A to I). These computer-controlled cannons fire pulsed R.F. and M.R. beams of quantum physics. The patient will lie on a moveable platform like a standard MRI machine. It's a full-body, wide-bore weapon with 864 guns and a parabolic reflector delivery system that uses specialist near-field antennas (K-μ ferrite type; near-field; gain; 10 dB). In the lower end of the electromagnetic spectrum, RFQMR generates multi-frequency, high-energy, spinning quantum electromagnetic beams at sub-Radio along with near-Radio Frequencies. Radiofrequency magnetic resonance beams are all needed for this therapy, so it's painless, non-invasive, and safe.

At this particular frequency, the intensity is quite low and thus does not effect the temperature of the tissues. The prescribed radiofrequency waves have a direct action on the cartilage cells. The computer is programmed to deliver a specific dose of R.F. beams from 1KHz to 100MHz in a magnetic field that targets the cartilage tissues using a special antenna.[1] Before RFQMR therapy, a 2D proton

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Fig. 1: Cytotron machine

density sequencing of the target tissue (tumor/cartilage) is gained utilizing MRI (magnetic resonance imaging). The dosimetry of the RFQMR beams is based on the proton density of target tissues. The software identifies the proton density data of all tissues from the skin to the target, and the dosimetry of RFQMR beams from individual guns generated is controlled. The computer plans the dosages in a sequence that it determines autonomously. For each different kind of tissue, the dosimetry process must be repeated. A laser guide pointing device allows for pinpoint beam focussing on the target area.

One of the recognized cellular signalling channels is transmembrane potential (TMP). The timely synthesis of numerous proteins in living cells is likewise controlled by TMP pathways. The hypothesis proposes that alterations to the spin-lattice of the hydrogen atoms in the molecular structure of the cell wall and the DNA inside may affect many factors involved in the control of the mitotic process (cell division and cell death). By these mechanisms, it effectively treats cancer by apoptosis of tumor cells[1] and osteoarthritis by mitosis.[2] Results in osteoarthritis prompt us to think about applying RFQMR to enhance the mandibular condylar cartilage growth in skeletal class II situations and thus increase mandibular growth.

2. Materials and Methods

2.1. Information sources

Electronic databases were searched systematically, including PubMed as well as Google Scholar. The selection process was limited to articles first published in English.

2.1.1. Searches

A search has been done through PubMed along with Google Scholar to find significant studies using keywords given in Table 1.

Table 1: Search strategy

S. No	Searches
1.	Rotational field quantum magnetic resonance
2.	Osteoarthritis
3.	Cartilage
4.	Cytotron
5.	Electromagnetic spectrum
6.	Transmembrane potential

2.2. Eligibility criteria and study selection

The "included" as well as "excluded" criteria were listed out. (Table 2). Publications were not considered for inclusion if they did not satisfy all inclusion criteria.

Table 2: Eligibility criteria for study selection

Inclusion criteria	Exclusion criteria
1. Studies on human patients with osteoarthritis of knee joint	1. Animal studies
2. Studies on human patients confirmed pathological diagnosis of cancer.	2. Patients treated with electromagnetic spectrum, studies showing other uses of electromagnetic spectrums
3. Patients treated with RFQMR using cytotron machine	3. Systematic reviews
4. Cross sectional, RCT, Non randomised studies	

3. Results

3.1. Literature flow

Forty studies were found in the first electronic search. The entire texts of 38 papers were reviewed after their titles and abstracts had been screened for relevance. Only 3 of them were deemed appropriate for inclusion in the evaluation. The summary of the data extracted from the selected articles is shown in Figure 2.

3.2. Results of included studies

Rotational Field Quantum Magnetic Resonance (RFQMR) is a technology that is made to deliver highly complex quantum electromagnetic beams in the sub-radio and near-radio frequency spectrum. The beams may be focused precisely on targeted tissues to produce a variety of voltage potentials in real-time. Table 3 presents an overview of the information obtained from the chosen articles and the excluded articles are listed in Table 4.

Vasishta et al. studied the impacts of RFQMR in treating osteoarthritis. By decreasing pain, increasing joint mobility, and initiating regeneration of damaged chondrocytes, RFQMR breaks the vicious cycle. One hour of daily RFQMR treatment on both knees for 21 days was utilized to

Table 3: The characteristics of included studies

Article	Study design	Sample size	Criteria for selection	Measurement method	Results
Wg Cdr VG Vasishta, Dr RV Kumar, Surg Cdr LJ Pinto	Cross sectional study	35 random subjects	Subjects with radiologically severe osteoarthritis of knee joint	Subjects were evaluated before, immediately post treatment and one month after treatment with the Knee Society Scoring System and dynamometry	Use of RFQMR treatment for osteoarthritis decreases pain, increases mobility, stability and power of the knee joint
V.G.Vasishta	Non-randomized, phase II study	195 subjects	Subjects with bilateral osteoarthritis of knees	Assessed on the basis of the internationally recognized Knee Society clinical rating system, and the scores were computed prior to treatment, after 21 days of QMR therapy, and at three months	Effective in ameliorating the signs and symptoms of OA, and inducing regenerative activity in the chondrocytes as evidenced by an increase in the cartilage thickness
Ranjit Kumar, Meena Augustus, Anjana Rani Nair, Reinhard Ebner, Gopalapillai Sreedharan Nayar, Rajah Vijay Kumar	Non randomised pilot study	98 subjects	Patients of either gender, predominantly adult, with confirmed pathological diagnosis of cancer, having solid tumors and declared terminally ill by the attending Oncologist	Quality of Life assessments, overall survival and tumor stability using RECIST v1.1 were evaluated and followed up for 12 months	Exposure to radiofrequency-mediated QMRT improved life expectancy and quality of life, along with arrest of tumor progression

treat 35 individuals with knee osteoarthritis. Dynamometry and the knee society scoring system assessed their progress before, during, and after therapy. This research showed that patients with osteoarthritis with RFQMR therapy experienced less pain, more knee mobility, stability, power, and a more normal quality of life. After a month of follow-up, the results were stable.[2]

The same findings were shown by Vasishta et al. in another similar study. 195 individuals with bilateral knee osteoarthritis (OA) were evaluated by The knee society clinical grading system. For 21 days, the subject's knees were treated with multi-frequency narrow-focused quantum magnetic resonance for 30 minutes a day using the Cytotron machine. At three months, the cartilage thickness had significantly increased in both knees, from 0.64 mm (±0.02) before treatment to 0.88 mm (±0.07) and from 0.65 mm (±0.02) to 0.89 mm (±0.05), respectively ($p < 0.001$) (Figure 3). When evaluated after three months, the progress still held. Quantum magnetic resonance beam therapy was beneficial in reducing O.A. symptoms and stimulating chondrocytes into regeneration activity, as measured by increased cartilage thickness.[39]

In patients with a pathologically established diagnosis of cancer, solid tumors, and declared terminally ill, Ranjit Kumar et al. employed a very similar patented system that used the RFQMR waves. After the initial screening, a total of 98 individuals were enrolled. The most prevalent cancer in the research was breast cancer, involving two primary instances without metastases. RFQMR exposure was 28 days, with 1 hour each day. Eighty-six (88%) of the patients who started the trial completed it. Forty out of eighty-six (47%) patients who received treatment were still alive 12 months later; when 0% was the predicted survival. Twenty-two patients, or 26%, lived for six months beyond the study's original end date when the projected survival rate was 0%. A total of 31 patients survived the completion of the research. Of the 86 patients who had finished treatment, 51 patients (59 percent) reported for the initial review one month after QMRT had finished. The magnetic resonance imaging results for 36 (71%) of these 51 patients did not demonstrate any interval change, worsening, or rise in tumor size, suggesting a persistent

Table 4: Excluded studies

Article	Reason
Ciombor et al [3]	Animal study
Ganesan et al [4]	Review
Vavken et al [5]	Meta analysis
Ozgüçlü E et al [6]	Device Elettronica Pagani used
Jansen JH et al [7]	Device Ortho-pulse®II
Shen WW et al [8]	Animal study
Warntjes JB et al [9]	Use other than treatment of osteoarthritis and cancer
Mentes et al [10]	Use other than treatment of osteoarthritis and cancer
Gupta A et al [11]	Use other than treatment of osteoarthritis and cancer
Jasti AC et al [12]	Use other than treatment of osteoarthritis and cancer
Sutbeyaz ST et al [13]	Use other than treatment of osteoarthritis and cancer
Saggini R et al [14]	Magnetotherapy device -BodyMag
Külcü et al [15]	Device other than cytotron
Pipitone et al [16]	Device other than cytotron
Van Nguyen et al [17]	Review
Sun et al [18]	Animal study
Ghibelli et al [19]	In vitro study
Matte et al [20]	In vitro study
Yamamoto et al [21]	Animal study
Mollon et al [22]	Meta analysis
Forosh et al [23]	Animal study
Bobacz et al [24]	In vitro study
Tofani et al [25]	Animal study
Yamaguchi et al [26]	Animal study
Fini et al [27]	Review
Stern et al [28]	Review
Ibey et al [29]	In vitro study
McLeod et al [30]	In vitro study
Aaron et al [31]	Review
Shupak [32]	Review
Rohde et al [33]	Use other than treatment of osteoarthritis and cancer
Martin Blank et al [34]	Review
Bassett et al [35]	Use other than treatment of osteoarthritis and cancer
Binder et al [36]	Use other than treatment of osteoarthritis and cancer
Choi et al [37]	Use other than treatment of osteoarthritis and cancer
Sintea et al [38]	Use other than treatment of osteoarthritis and cancer

change in disease. Tumor shrinkage was reported in 4 (8%) patients at the time of the initial evaluation, whereas tumor progressed in 22% of patients over this observation period. Life expectancy, quality of life, and arrest of tumor growth were all enhanced by radiofrequency-mediated QMRT.[1] From now on, the rate at which cells divide or die in living tissues may be manipulated using rotational field quantum magnetic resonance (RFQMR).

4. Discussion

It has been shown that exposure to electromagnetic fields may have a broad range of physiological impacts on different cell types and tissues. Examples of disorders in which pulsed electromagnetic fields have been employed for therapy include osteoarthritis,[3–6] osteoporosis,[7,8] multiple sclerosis,[9,40] wound healing,[10–12] fibromyalgia,[13] tendonitis and pain.[14] Patients with other chronic degenerative illnesses, for example osteoarthritis (OA) and Multiple Sclerosis (MS) have benefited from using RFQMR in a clinical trial settings.

In the sub-radio and near-radio frequency range, RFQMR is designed to provide a very complex quantum electromagnetic beam pattern with precise external command and control.

Osteoarthritis is a degenerative disorder that primarily affects the articular cartilage, which is most prevalent in weight-bearing joints and the fingers. The chondroblastic layer is continually replenished in order to maintain a supply of hyaline cartilage for use as a protective cap on long bones and the inner surface of the patella in the knee joint. As long as the joint is moving, this mechanism will be engaged.

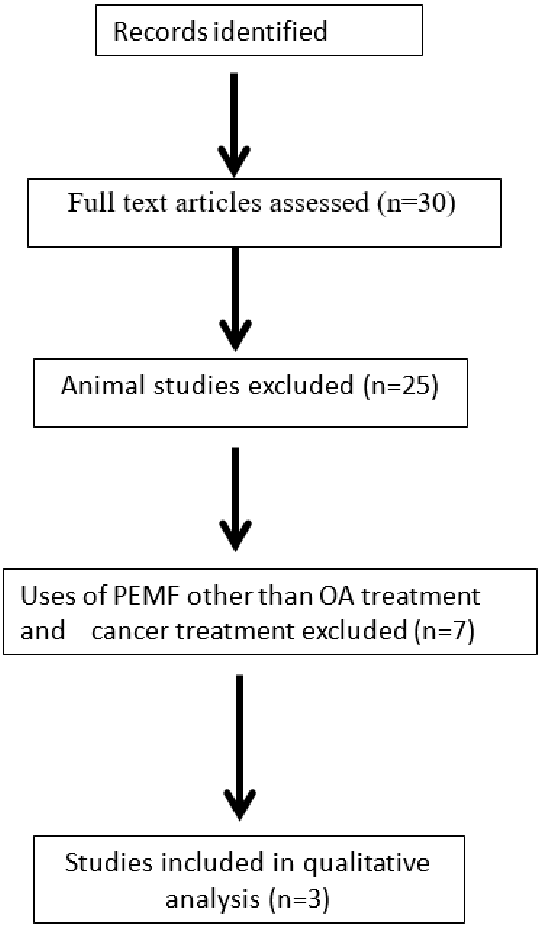

Fig. 2: Flow diagram for study selection process

Fig. 3: Pre and post treatment cartilage thickness

The cartilage lining the ends of the knee's articulating bones becomes worn down with time. The early beginning of degenerative change is caused by overuse, frequent impact, and trauma. Because chondroblast's regeneration potential diminishes with age and sedentary lifestyle, osteoarthritis progresses rapidly in older people. As the cartilage deteriorates, joint discomfort worsens, leading to decreased mobility, leading to the weakening of the supporting muscles and an increase in stress on the afflicted joint. The chondrocytes are activated and the regeneration process is initiated by RFQMR, which reduces pain and improves joint mobility by causing a spin in the hydrogen atoms within the cell and establishing a streaming potential inside the extracellular matrix.[2]

Placing a weight on the joint, compresses the cartilage and thereby displaces the fluid with in the cell, carrying with it mobile ions, sodium ions and leaves behind the negatively charged proteoglycan carboxyl and sulfate ions. As a result of the de-neutralization of negative charges, an electric potential is created known as the Streaming Potential. Joints damaged by illness or trauma may benefit from RFQMR's restorative benefits since the Streaming Potential can be recreated using RFQMR.[2]

The effect of streaming potential on cartilage tissue is as follows.

1. At rest, the extracellular cartilage matrix is characterized by a balance between hydrogen protons and negative charge carriers. As a result, there is no resting regeneration and no streaming potential.
2. During natural regeneration, a Streaming Potential is generated within the extracellular matrix as a result of load bearing, the result of the active outflow of hydrogen protons and the efflux of fixed negatively charged fluid from cartilage tissue.
3. Because of the change in QMR spin in the hydrogen atoms, the regeneration of cartilage induced by RFQMR generates a streaming voltage potential flow in the joint, stimulating chondrocytes in the extracellular matrix.

Since treatment of malignancies is not in the preview of this article and since this is an essential feature, a very brief description of the mechanism of action of the

ytotron device in this aspect is described**.** Dosimetry allows for the exact focusing of extremely complex electromagnetic beams in the 30 kHz to 300 MHz radio frequency range on specific tissues in order to alter their membrane potential. It affects the development of solid tumors by inducing apoptosis (programmed cell death). Differences in ion concentration between the interior and outside of a cell generate an electrochemical force across the membrane, known as the membrane potential (Vm). Typically, a healthy cell's membrane potential will be between -70 and -90 mV. Various studies have demonstrated significant membrane potential depolarization during the malignant transformation of normal cells. The membrane potentials could be "artificially modified" to prevent tumor growth and inhibit metastasis. Studies have shown that tumor cells are more susceptible to apoptosis after exposure to Magnetic Resonance. The p53/p73 driven protein-signaling pathway was responsible in this case. Treatment of malignant lesions has shown that the Cytotron can induce controlled changes of the transmembrane potential to modify cellular activity and impact cellular command and control.[1]

5. Orthodontic Implications

The orthodontic implications of this untouched science of RFQMR could create an immeasurable change in functional therapy.

It could be very beneficial in treating skeletal class II situations where mandibular growth stimulation is required, especially in growing patients. Today it is a proven fact that this unique treatment modality has successfully treated osteoarthritis patients by enhancing the growth of the cartilage in the knee joint. Various investigations have demonstrated that the cartilaginous growth has been enhanced by 0.3mm in just 21 days with this treatment.[39] This outcome can directly be compared to the increase of approximately 1.9 mm in mandibular length as reported in most studies with functional appliance therapy with the twin block appliance lasting for an average of 15 months of treatment duration.[41] Thus, the rationale would be that if the RFQMR could increase cartilage growth in adults, it could probably ensure better results in the condylar cartilage of young, growing patients.

The various treatment sequences possible by combining the RFQMR and functional therapy are several:

1. The RFQMR could be targeted directly on the condylar cartilage. If successful, then it would eliminate the need for complex functional appliances.
2. It could be combined with functional therapy.
3. It could be considered post-functional therapy, especially if the results were unexpected.
4. It could help patients requiring mandibular advancement in the post-pubertal stages.
5. It could be an adjunct in non-co-operative patients with functional appliances.

While using RFQMR with functional appliance therapy, the main thing to be noted is the appliance design. Since the cytotron is a modified MRI machine, the usage of metal components in the appliance has to be avoided. Hence, a fixed twin-block appliance with upper and lower bite blocks cemented would be the choice (Figure 4).

Fig. 4: Appliance design of twin block to be used with RFQMR

These various sequelae, which work best, must be tested and proven with time. One of the discrete features of the RFQMR is target specificity. The R.F. waves are programmed to act exactly at the requirement site, bone or cartilage. Thus, its capabilities would need to be time tested and proved in other fields of dentistry like bone regeneration and TMJ disorders.

6. Conclusion

Patients with osteoarthritis report considerable subjective and objective improvement after receiving RFQMR treatment, allowing them to resume normal life activities. The results suggest that this non-surgical, non-invasive therapy is a landmark treatment for OA, potentially reversing the osteoarthritis disease process. Also, stabilizing the disease in cancer patients by arresting tumor progression in a very unique way is a break through. Its implications in orthodontics would be very useful in functional therapy, and its capabilities need to be time-tested and proven.

7. Source of Funding

None.

8. Conflict of Interest

None.

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