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Research article

Pulsed Electromagnetic Fields and Tendon Damage in Shoulder Osteoarthritis: A Brief Review of its Potential Restorative Role

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Abstract

Osteoarthritis, a painful oftentimes disabling joint disorder involves progressive and distinctive biologic as well as structural alterations of the articular cartilage tissue lining and associated muscles and tendons of freely moving joints such as the shoulder. In this brief overview we examine the rationale for, and potential efficacy of applying pulsed electromagnetic fields clinically for purposes of reducing shoulder osteoarthritis pain and other related disease features such as tendon tears, and cartilage damage in the older adult population. Based on selected English language literature published largely on PUBMED between January 2000 and September 2025 it appears some favourable changes in pain and disease manifestations may be forthcoming from the application of pulsed electromagnetic fields in some form to a damaged shoulder joint in the face of rotator cuff damage. Further clinical research alongside comparable lab studies appears strongly indicated to better validate the efficacy of pulsed electromagnetic fields in efforts to facilitate shoulder function and possible joint reparative processes in older adults with joint derangement and dysfunction.

Keywords: Articular cartilage; osteoarthritis; pulsed electromagnetic fields; rotator cuff; pain; shoulder; tendon; treatment

Introduction

Osteoarthritis, the most common form of arthritis is a disabling joint disease usually accompanied by varying degrees of focal structural and functional pathologies of the cartilage tissue lining one or more synovial or freely moving joints such as the shoulder. In addition, the condition, also termed glenohumeral osteoarthritis, may be accompanied by varying degrees of tendon attrition as well as extensive joint destruction due to remodelling of those bone surfaces and margins that lie adjacent to cartilage and interface with four key shoulder muscle tendons to form a stabilizing structure for the related shoulder muscles and humeral bone complexes termed the rotator cuff. As well, there may be varying degrees of: shoulder joint inflammation, tissue impingement, muscle weakness, muscle mass declines, active and passive movement limitations, losses of joint stability, joint stiffness, diminished muscle endurance, functional challenges and adverse local and central reactive neural responses that contribute to the disease burden [1].

Unfortunately, as for osteoarthritis in general, not only is the disease accepted as being incurable or inevitable, but no well accepted method of apprehending the disease in its early stages or in averting or effectively allaying shoulder osteoarthritis in the older adult population prevails. While this situation may reflect the fact that the condition is commonly an emergent one often hard to detect and verify in its subclinical phases and only manifests clinically in its more advanced years and disease stages, the shoulder as a vulnerable disease site is rarely studied or the focus of any widespread public health campaigns to offset known risk factors. Moreover, even if apprehended in a timely way, its treatment is not straightforward and must address a wide array of interacting possible multiple painful joint functional challenges as well as varied degrees of joint derangement and inflammation.

Affecting high numbers of aging adults, the primary signs and symptoms of shoulder osteoarthritis other than pain commonly interact to disrupt the adult's ability to function physically, and their psychological health may be highly impacted and impaired, along with their ability to act independently, as well as socially and economically with a high quality of life, if we at a minimum consider the role of arm use for feeding, smart phone use, bathing, hair styling, driving, carrying, reaching, gripping, and dressing. Sleep may be especially impaired as well. Since there is no cure for osteoarthritis, older adults who incur unrelenting pain may have to rely solely on medication, injections, or surgery to reduce this, or to enable them to simply remain in the community, even if potentially hazardous in the older population [1]. Among the non-medical or invasive therapies often applied in this regard are however a wide array of electrotherapeutic modalities with each showing some promise in improving one or more osteoarthritis signs and symptoms even though well-designed research in this field had been elusive and remains limited and non-conclusive or consistently overlooked [2].

In this respect, one modality constituted by low-frequency/ energy pulsed electromagnetic fields or PEMF applied as a single or pulse burst quasi-rectangular or triangular waveform, has been found to have some promise in this respect in some cases [3-6], especially in the case of early osteoarthritis [7,8], or in its own right as a form of therapeutic support [7,9]. The mode of stimulation is also observed to have the ability to accelerate or reinitiate healing [10,11] and to relieve pain [12]. Its multiple benefits when observed as an application for ameliorating osteoarthritis disability have also included the mitigation of joint inflammation, and associated bone damage, plus the possible 'healing' or regeneration of articular cartilage and soft tissue lesions found to varying degrees in osteoarthritic joint disease [1-3].

Aims

To gain current insights regarding how pulsed electromagnetic fields may benefit an aging shoulder osteoarthritis sufferer, we aimed to uncover:

a) Findings regarding the use of pulsed electromagnetic fields for the treatment of painful osteoarthritis shoulder joints in general, and specifically from the viewpoint of its interaction with cartilage and tendon cells and their influence on collagen composition that provides for joint structural integrity and function as viewed largely in laboratory-based studies.

b) Existing evidence of the extent of its clinical potential and possible underlying mechanisms of action as deduced largely from preclinical studies.

c) A role for efforts to advance tendon repair and healing relative to pulsed electromagnetic field applications, specifically in the context of shoulder osteoarthritis in the older adult with diverse degrees of rotator cuff damage, and where rotator cuff surgery is often compromised [16].

Rationale

It is increasingly apparent that osteoarthritis treatments currently fail to produce results commensurate with the many research efforts on the topic no matter what joint is studied. In terms of pain relief alone, the growing usage of narcotics and other medications plus invasive injections to quell pain implies a failure to address this universal complaint and feature of osteoarthritis [13]. On the other hand, even if osteoarthritis is continuously viewed through a degenerative lens, various forms of bio physical stimulation such as low energy, low frequency electromagnetic fields have been shown to trigger a variety of biological cellular responses via specific membranous and intracellular biological pathways that can impact articular cartilage cells or chondrocytes, subchondral bone synovial membrane and connective tissue cells such as tenocytes within tendons so as to foster their potential inherent ability towards fostering tissue matrix synthesis and a host of reparative metabolic capacities [7,14]. What has been shown quite convincingly is that due to their differential abilities to stimulate or trigger selected cell based molecules that underlie various joint structural components, intermittent or low frequency externally applied electrophysiological applied fields may favorably influence multiple intrinsic joint structures such as cartilage cells, bone cells, possible muscle and tendon cells and others [11,15] as opposed to several mainstream current approaches that are helpful in decreasing shoulder pain, but neither stop the disease progression nor improve the highly disabling osteoarthritis condition [17].

Other reports show that although not explicitly mentioned by Lowry et al. [18] or Wright et al. [19] as per Preetum et al. [20] there are potential benefits and mechanisms of electrical stimulation in wound healing that might be extended fruitfully to the shoulder joint exposed to trauma, due to their ability to stimulate cellular responses that promote tissue regeneration, and improve overall healing outcomes. It is probable too that the application of some forms of electrotherapy can serve as a beneficial adjunctive therapy for various types of wounds, including those at the shoulder joint involving chronic cartilage, muscle and tendon lesions, and possible surgical site incisions. In the context of tendon degenerative disorders, for example those that can impair or exacerbate shoulder osteoarthritis disability and pain in the elderly, it is quite probable that if innovative conservative treatments that involve pulsed electromagnetic field applications are applied thoughtfully, they can potentially improve the intrinsic healing potential of injured rotator cuff tendon tissues progressively and effectively [21-23]. This effect alone may vastly improve any prevailing shoulder based mechano-sensing and tensile force capacity and those motor functions required to foster favorable biological processes, rather than those evoked by shoulder instability.

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In accord with Tucker et al. [24] it appears older adults with shoulder osteoarthritis and rotator cuff tears who often require surgical interventions albeit with a high failure rate may improve [25]. At the same time, inflammation may be reduced; bone and ligament health may improve, along with joint shock absorption and the processes of cartilage regeneration, tendon mechanical property enhancement, and pain [26], and its possible unrelenting impacts on an array of debilitating cognitive symptoms such as anxiety [27-30]. While largely ignored in the current orthopedic literature in favor of medication or invasive therapies it appears pulsed electromagnetic field applications when applied alone or as a complementary modality may be especially helpful in efforts to curtail considerable suffering in later life for many with varying degrees of tendon derangement and chronic disabling shoulder osteoarthritis. Judicious use may also reduce the immense societal health costs of shoulder osteoarthritis, while improving the sufferer's joint stability, and function.

Most importantly, their application may conceivably help to reduce any attendant stress provoked cognitive state often found to increase progressively in those diagnosed as having osteoarthritis rotator cuff damage that can significantly reduce confidence as well as daily living functions and motivation to comply with health recommendations and should not be overlooked. They could help counter an aversive downward disease spiral due to otherwise persistent cartilage matrix degradation and joint dysfunction including possible shoulder instability that often increases over time. One application barrier in this regard is that the degree of influence afforded by pulsed electromagnetic field tendon applications in the shoulder affected by one or more rotator cuff tendon lesions is not only poorly studied, but disputed by some despite its possible utility. Here, we found it best to rely largely on what we have learned from multiple lab-based studies that are often insightful and well designed as a gateway to the future bedside.

Methods and Procedures

After studying this topic for many years, we elected to garner some current and past information on this issue and others posted over time on PUBMED, PubMed Central, and GOOGLE SCHOLAR accepted as reliable medical literature sources. Key words used were: Articular Cartilage, Older Adults, Osteoarthritis; Pulsed Electromagnetic Fields, Rotator Cuff, Shoulder Joint, Tendons All forms of study were accepted, but no systematic analysis or synthesis of either the laboratory or the clinical literature was attempted-given their diversity and limited numbers of recent studies. A focus was placed on selecting and reviewing preclinical data and their clinical implications for tendon lesion repair in narrative form. Protocols for future study, sports injury associated studies, conference proceedings, and non-English or incomplete studies were excluded as were many early citations covered in the reference section of reference 32. It was assumed most studies were acceptable to experts in the field and those published may not include all negative findings. However, it was assumed a general picture of the state of the art would be attained with relative confidence when assessed very carefully and across multiple perspectives and substrates. No other forms of intervention were examined. Readers interested in clinical and past analyses and observations may want to examine references [5,10,13,23,31-33].

Results

Several past studies show the osteoarthritis joint topic presently studied, namely that at the glenohumeral or shoulder joint is the third most common large joint affected by the disease. Although often unreported, we know this condition is quite common with data showing 16% to 20% of adults older than 65 years to have radiographic signs of this condition. Conservative therapies, including oral drugs, injections, and physical therapy are only modestly successful at best however in reverting or attenuating the condition, and many older adults may suffer unduly since their needs are poorly identified or understood if compared to those at the knee and other vulnerable joints. Joint replacements or surgeries often considered if the use of conservative measures appears ineffective predominate the intervention approaches cited as viable and impactful in 2025. However, surgery does not yield benefits for all especially those with tendon lesions. Moreover, while less potent perhaps, conservative non-invasive physical therapies appear safer for older adults when considering harm that can arise from oral drugs, injections, and surgical management challenges [34].

Other data reveal that since the early 1970s when several researchers began to examine pulsed electromagnetic fields and their interactions with cartilage and bone cells, this topic has continued to be of interest and very informative in the context of its basic potential to mitigate osteoarthritis. Most, albeit not all continue to largely lend support to using or studying this mode of physical energy as a form of osteoarthritis therapy in the future, regardless of methods of inquiry that includes but is not limited to an array of cell culture assays, animal models of osteoarthritis, animals with naturally occurring or age associated osteoarthritis, stem cell substrates and cartilage and bone explants [32,33].

Dolkert et al. [35] explain that the current interest in this topic is quite important in that rotator cuff tears are common musculoskeletal injuries which often require surgical intervention that may be expensive, contraindicated or less than effective if chronic tendon tears prevail. However, the application of non-invasive pulsed electromagnetic fields approved for treatment of long-bone fracture nonunions and as an adjunct to lumbar and cervical spine fusion surgery that may be helpful is not applied to any degree in 2025.

Maximizing shoulder function is however, key to mitigating tendon attrition and possible cartilage and bone degradation that occurs in advanced shoulder osteoarthritis especially if tendon cells that foster collagen production and joint sensory motor functions as well as joint position sense and cartilage membrane receptors stretch sensitivity are subject to persistent impacts or no motion in the case of a 'frozen shoulder'. Applied optimally, the fields can be shown to further affect bone formation and negate adverse physiological processes in the bone marrow tract, an osteoarthritis peripheral pain site. It can reduce muscle dysfunction, while possibly improving more physiological ranges of joint motion and the ability to withstand joint impacts [36].

Along with its pain-relieving potential, this modality is thus one likely to be conducive to one or more desirable outcomes for those older adults with debilitating shoulder osteoarthritis who may well face chronic daily and nightly degrees of suffering, but seek independence [37]. As a result, Rosso et al. [38] conclude that although the pathogenesis of tendon degeneration and tendinopathy is still partially unclear, an active role for countering metalloproteinase degrading enzymes, as well as fostering cytokines and growth factors that are designed to play a crucial anabolic role in joint and tendon status may be favorably influenced by pulsed electromagnetic field therapies and others.

Strauch, et al. [39] imply the above processes such as improvements in rotator tear morphology may well occur in the face of the application of electromagnetic fields if they are configured to enhance Ca2+ binding in the context of growth factor cycle cascades involved in tissue healing. They reportedly observed this latter physiologically enhanced process helped to achieve a marked increase of the tensile strength measures recorded at the tendon repair site in an animal model that might be emulated in humans, especially if this is begun earlier rather than later when the risk of developing adhesions or rupturing the tendon in the early postoperative period is considerable. In addition, Yang et al. [40] who examined a mouse model of osteoarthritis and others affirmed pulsed electromagnetic field applications were able to attenuate the degree of ensuing osteoarthritis and its progression due to its ability to inhibit inflammatory signaling processes at the artificial tendon injury site. Importantly, the stimulation appeared to significantly attenuate the structural and functional progression of osteoarthritis commonly found to emerge in this pre-clinical disease model. The pulsed fields appeared to attenuate the magnitude of verifiable cartilage chondrocyte death processes and were hence deemed protective and important to pursue.

Wang, et al. [41] agree that pulsed electromagnetic stimuli can foster a state of cartilage chondrocyte proliferation, while exerting a protective effect on cartilage cell catabolic actions and their impact on the cellular environment, including its catabolic impacts that may place excess strain in joint tissues such as its tendons. Cadossi, et al. [42] propose that these aforementioned results and others are not unexpected if one considers that cell membrane receptors at the stimulation site appear to induce signals that have dose-like response effects as far as the synthesis of structural and signaling extracellular matrix components of cartilage is concerned. Through these actions, the structural integrity of bone and cartilage can undergo enhanced repair, and can alter the homeostatic balance of cytokines, producing anti-inflammatory effects with a pro anabolic effect on the bone and cartilage matrix, as well as an anti-catabolic effect. Furthermore, this form of stimulation may foster cartilage and tendon healing [42] and a degree of pain relief that may help stabilize or improve bone structure and the overall ability of the affected adult to function physically [14,43-47].

As per Di Geralmo, et al. [45] low frequency pulsed electromagnetic field waves have proven to be effective in the modulation of bone and cartilage tissue functional responsiveness, and are not cytotoxic, rather they act as anti-inflammatory stimuli. Employing careful analyses their data specifically demonstrated that stimulation of tendon cells positively influences, in a dose-dependent manner, the proliferation, tendon-specific marker expression, and release of anti-inflammatory cytokines and angiogenic factor in a healthy human culture model that may help in the human situation that remains so problematic. Another group [48] who studied transcriptome-wide responses of Il-1β-primed rat Achilles tendon cell-derived 3D tendon-like constructs after high-energy pulsed field treatments were applied found various verifiable biological processes to be affected, including extracellular matrix remodelling and a down regulation of cell death observations. Further, members of the cytoprotective interleuken family and its decoy receptor were found to be positively regulated post exposure and this important set of findings may well help to optimize current treatment protocols as well as the possible benefits of non-invasive therapy as well invasive surgeries commonly applied to mitigate shoulder tendinopathies and shoulder structural derangmeents. In addition, there may be a significant and favourable impact on muscle repair [49] even in the face of a state of tendinopathy that stems from post stimulation improvements in muscle fiber alignment, force transmission, contractile function, and muscle recovery, as opposed to tendon related muscle dysfunction [50-52] and progressive harmful tendon tendinopathy and tendon degeneration [53].

Moreover, long lasting inflammatory signals that compromise tendon homeostasis and promote tissue degeneration, and matrix production may be mitigated following pulsed field stimulation therapy [54] and in those cases over 70 years of age, where shoulder strength may be reduced by 30% with small and 40% with large full thickness tears, exposure to electromagnetic pulse waves may yet improve the subject's strength and associated ability to perform activities of daily living [50,55] or help to avert rotator cuff repair failure due to poor tendon healing, particularly at the shoulder bone tendon interface versus potential healing of the irradiated tendon and bone [11,16,56]. In sum, although not all published preclinical studies examined in this overview favour any form of pulsed electromagnetic field stimulation as far as having beneficial cartilage cell, tendon, and pain impacts, more positive than negative or null conclusions prevail. However, as in many current realms of inquiry, these consistently affirmative and promising data that are found in non-clinical studies must be extrapolated with some caution to the bedside as they may not translate directly or respond to a one size fits all approach. In this regard, at the very least, the fact that osteoarthritis derived cartilage cells do respond to biophysical stimuli is promising and warrants future study as this alone may have a positive impact on any prevailing tendon lesions or risk thereof. In addition, secondary bone and adjacent tissue repair may have the potential to not only avert osteoporosis due to inactivity but to foster cartilage viability and possible repair directly, as well as by its positive impact on muscle structure and function.

In this regard we believe the following points by, Varani et al. [56] are valid as follows.

a) The application of pulsed electromagnetic field stimuli can likely improve the functional and mechanical properties of key shoulder joint tissues in the older adult such as cartilage, tendon and bone and may favor graft integration in tendon repair, while controlling inflammation.

b) Experimental factors however, including a lack of careful consideration of the nature of the measurement properties as well as suboptimally applied factors could slow or interfere with healing.

c) The failure of most clinical studies to employ advanced technologies that can detect cartilage and tendon cell transformations at the nano molecular level as well as functional mechanics may weaken the chances for valid insights of high veracity to emerge despite this being quite a promising line of pursuit.

As well, the study of homogeneous osteoarthritis groups other than the knee joint may yield rather than contaminate the attainment of meaningful and insightful results to supplement those already observed [32,33]. Carefully considered integrated therapy efforts that proceed in the face of optimal exposure and stimulus dosage also hold great promise, even if disputed.

Discussion

The question of whether an older adult suffering from painful incurable progressive disabling osteoarthritis of one or more joints might be helped therapeutically and safely using non-invasive nontoxic passive methods is a well-studied topic of high clinical and public health relevance, especially in aging adults where age and pain are correlated with radiographic damage [57]. In this current overview that spanned a 50-year time period application derived from pulsed electromagnetic sources show consistent promise in ameliorating osteoarthritis disability and can serve as a bridge to cartilage and soft tissues and muscle repair and pain relief in selected osteoarthritis cases [10]. It can also exert a positive role in the tendon healing process that is not achieved readily, but is very disabling. As well, they may promote bone healing [58,59], as well as tendon healing.

Moreover, several notable plausible evidence-based mechanisms appear to support the impact of pulsed electromagnetic fields in reducing pain. It also indicates that it could be beneficial to treat any existing tendinosis at an early stage with this modality so as to avert any possible progression of the osteoarthritis disease process [60]. To guide challenges faced by health providers in the realm of chronic shoulder osteoarthritis in the high aged adult [1], and the immense related personal and societal burden, a number of positive laboratories based preclinical study results clearly show the potential efficacy of pulsed electromagnetic field therapy for shoulder osteoarthritis mitigation and must surely warrant consideration and comprehensive study in the future to avoid ignoring its probable benefits. Indeed, even if other interventions are helpful and take less time, the ability of most to directly impact the actual joint pathology is limited and/or can undoubtedly foster one or more disabling physical, social, or mental health disease correlates as result.

Additionally, unlike most other physical therapy modalities which often invoke tissue heating and subsequent destructive enzyme activity, and possible joint swelling if excessive, pulsed electromagnetic field applications can be applied with no heating effect to mimic those mechanical stimuli known to favour the production of molecules that can foster extracellular cartilage matrix production, joint mobility and stability [16]. In addition, it is possible that its insightful application using thermal doses may yet relieve pain and muscle spasm that accompanies the disease, but currently evidence here is very limited and non-diverse [5]. Third, its application could help repair bone damage, which may be causing or perpetuating the progression of the osteoarthritis disease process to some extent. However, if we accept many decades of collective evidence that implies articular cartilage cells are indeed highly responsive to electrical, mechanical as well as chemical stimuli and can be manipulated accordingly by selected pulsed electromagnetic field effects, as can bone and supportive tissue structures and molecular pathways that may enhance tendon remodelling, it appears harmful effects of immobilization driven by pain, along with excess joint stresses and degradation can be minimized if not averted [31-33]. Careful applications may further obviate the need to resort to narcotic usage that may prove addictive. Its anti-inflammatory, effusion, and pain reducing properties, may prove equally valuable in helping the affected individual to exercise, especially important in early as well as late life osteoarthritis.

In addition, because pulsed electromagnetic fields can be applied non-invasively and safely plus alone or in combination with other treatments, possible functional benefits may emerge without any possible injury to joint neural structures that may be debased by nerve blocks, intra articular injections, or surgery. Unlike exercises, since these magnetic waves can be applied even in the absence of movements that are often hard to perform in the case of pain, benefits may extend to reductions in joint swelling and inflammation, better post-surgery healing effects, and cartilage preservation. These beneficial impacts are not spurious and have increasingly been attributed to several measurable mechanisms of action including reductions in damaged cartilage cell numbers, density, and morphology, favourable m-RNA effects, protein and cytoskeletal regulation, and an apparent ability to reduce inflammation, destructive enzyme actions, and the extent of premature cartilage cell death. The waves can exert stimuli that foster tendon cell DNA synthesis, and collagen production potential and muscle regeneration, of high import in the shoulder osteoarthritis disease cycle [8].

It is the author's belief therefore that pain, stiffness and function at the osteoarthritis shoulder joint may be safely improved alongside reducing its growing economic burden with younger adults being increasingly affected [66] consequent to multiple post pulsed electromagnetic therapy impacts, even among those with marked derangement and of high age and in light of its established regenerative capacity. In particular, noxious symptoms and sleep problems may decline, and functions favouring life quality may ensue. Potentially too, carefully designed treatments can be shown to help postpone invasive surgical interventions or obviate these especially if dosages and wave parameter choices and direction of stimuli are tailored and targeted insightfully based on what is known at both the cellular as well as the molecular realms about enabling key genetic operations and uptake responses as well as desirable gene functions and expression to emerge post bio stimulation.

However, to validate any of these ideas, and expand the promise of this understudied realm, further well designed prospective studies using more advanced state of the art diagnostic tools and technologies, alongside efforts to examine intrinsic cartilage, tendon, muscle, and bone health status with rigor and fidelity across carefully selected groups using sensitive and reliable standard pain and radiographic or CT scan measures as well as secondary measures of pain perception, arm usage, and proprioceptive functions. Based on multiple successful preclinical studies, specific intracellular mechanisms of action and improvements in sensorimotor function that may yet be effective in clinical disease modifying efforts should be sought as well [5,8,61], even in damaged joints and in those with hyperalgesia or in surgical recovery [69,70]. The documented link between knee osteoarthritis and the risk of older adults developing shoulder osteoarthritis also warrants study [62] as does shoulder osteoarthritis in the aging adult population its own right and here pulsed electromagnetic field therapy of differing modes of usage should be thoroughly examined without obvious exposure to confounders such as co-interventions [63,64,66-70].

Conclusion

Although many older adults suffer with osteoarthritis without much relief, and despite favourable preclinical related observations of possible relief and even disease regression or repair post electromagnetic stimulation, the shortcomings of clinical studies, and especially those relying largely on aggregated data to guide clinical decisions in this sphere hampers the ability to decrease it destructive manifestations. This is not only due to an inconsistent array of studies that are inclusive of clinically meaningful well designed research reports. As such, and after studying this topic for many years, it is still worthwhile in our view to pursue in light of the increasing rates of worldwide suffering among the older population from potentially treatable osteoarthritis pain. Here, we advocate with reasonable confidence that clinicians should consider that the benefits of applying pulsed electromagnetic field treatments to quell osteoarthritis pain safely and to foster function earlier rather than later. They may gain insights here as to their client's progress or lack thereof in this regard and thereby garner insights for more 'practice based' evidence rather than sole reliance on evidence bases alone to emerge.

Indeed, while this broad-based overview may not have included all available studies, and the quality of those identified cannot be readily established or readily and rigorously validated in many cases, it

appears safe to offer four key conclusions as follows:

a) Low frequency pulsed electromagnetic fields may provide a safe and well tolerated form of biophysical energy that can be harnessed and titrated to promote intrinsic tissue healing, cartilage viability, and attenuate joint pain and inflammation found in shoulder osteoarthritis [65-70].

b) Older individuals with chronic shoulder osteoarthritis may have a good chance of benefiting from the application of pulsed electromagnetic fields to their affected joint, and mitigating its progression especially if applied at the outset of the condition or shoulder trauma or possibly pre and/or post operatively.

c) To validate and clarify the potential of pulsed electromagnetic fields as it may offer a cost effective means of reducing considerable suffering in older adult who experience shoulder tendon damage or tears-a key shoulder osteoarthritis correlate- careful research and more dedicated collaborations between biologists, biochemists, pathologists, rheumatologists, and other health personnel to lay the groundwork for a unified approach of applying pulsed electromagnetic fields clinically to evoke favourable chondrocyte as well as tenocyte gene activity and tissue repair responses and others is strongly encouraged.

d) Extending research efforts to embody the features of the whole shoulder joint and their interactions in the older adult population if impaired as well as with their reaction to pulsed electromagnetic field therapy plus its added impact on possible complementary interventions such as collagen intake maximization, joint protection approaches, and shoulder muscle strength training is also likely to prove highly promising.

Final Comment

The fact that transcriptional, cellular and sub-cellular molecular effects within damaged cartilage, tendon, and bony tissues have been quite well documented and replicated must surely keep the door open for those interested in undertaking and unravelling possible clinical applications to mitigate late life chronically disabling shoulder osteoarthritis or even arrest or reverse this disease especially among those who cannot undergo surgery or use medication.

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Conflict of Interest

No conflict of interest.

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