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A Novel Ayurvedic treatment - Arthrothermia® for Osteoarthritis

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ABSTRACT

Purpose: The purpose of this study was to report promising data revealed by a novel *Ayurvedic* treatment; Arthothermia® for patients with knee osteoarthritis (OA). **Method:** We enrolled 30 patients with OA who received Arthothermia® treatment. The Knee injury and Osteoarthritis Outcome Score (KOOS) was used to evaluate the treatment outcome. The five subscales of KOOS: Pain, Other Symptoms, Function in daily living (ADL), Function in Sport and Recreation (Sport/Rec), and knee-related Quality of Life (QOL) were scored separately. The KOOS data was calculated for the 30 patients before and after Arthothermia® treatment. **Results:** The KOOS before Arthothermia® ranged from 3.37 to 31.3. The KOOS was significantly improved after Arthothermia® and it ranged from 83.67 to 98.53. The difference in KOOS between before and after Arthothermia® treatment was calculated for the 30 patients as a group (unpaired t-test) as well as for each patient individually (paired t-test). The difference in KOOS was highly significant ($p<0.0001$) for both; unpaired and paired t-test analysis. **Conclusion:** The present study documented that the "Arthothermia®" – a unique Ayurveda treatment approach (combination of alkaline cautery and indirect micro thermal cautery) brought significant changes in KOOS in the OA patients in very short time duration. The promising data hold a ray of hope for better management of OA and needs wide explorations to bring magnificent outcome for patients suffering with OA.

Key words: *Janusandhishula, Vata Vyadhi, Sandhigata Vata, Osteoarthritis, Arthrothermia®*

INTRODUCTION

Osteoarthritis (OA) is a common degenerative joint disease that affects millions of people worldwide. It is characterized by the gradual breakdown of cartilage in the joints, leading to pain, stiffness, and reduced mobility. While several treatment options exist to manage the symptoms of OA, there is a constant quest for more effective and innovative therapies. As of today, it is estimated that there are approximately 15-20 million individuals living with OA in India. In addition actual estimate of OA is still higher due to the unreported and undiagnosed OS conditions in certain regions. In the coming years, the number of OA patients in India is expected to increase significantly. This projected increase can be attributed to several factors, including an aging population, sedentary lifestyle patterns, rising obesity rates, and an increased awareness and diagnosis of the condition.[1] Additionally, the prevalence of OA may also be affected by socioeconomic factors and access to healthcare services.[2]

OA is not just a condition that impacts older people. More and more people under age 30 are being diagnosed with OA, causing them to potentially face lifetime of symptoms. OA is characterized by the gradual breakdown of cartilage in the joints, leading to pain, stiffness, and reduced mobility. Various investigators are working to tackle the challenges faced by millions of people who live with OA.[3] The attempts include exercise, tai chi, and self-efficacy or self-management programs as first-line treatments (non-pharmacological) and no effective disease-modifying

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medications have been identified for OA, hence Oral nonsteroidal anti-inflammatory drugs (NSAIDs), intra-articular corticosteroid injections are advised some times (pharmacological actions). For conditionally management, Acupuncture and thermal (i.e., applied heat or cold) interventions should be considered for small improvements in pain and function, Balance training with or without strength training and Cognitive behavior therapy are conditionally recommended.[4] However, the challenges that make going to work, taking care of families, pursuing goals, remaining active and more - sometimes feel impossible. None of the attempts has been able to find a cure, however, scientists are working every day to identify ways to prevent OA, facilitate early diagnosis, provide new and better treatments and improve quality of life. Therefore, there is a constant quest for more effective and innovative therapies.

Ayurveda stands as a meticulously designed code of conduct, dedicated to fostering healthy and joyful living. It has been cherished in India for over three millennia. The cornerstone of Ayurveda, the '*Charak Samhita*,' imparts fundamental principles for both preventing and curing ailments.[5] Meanwhile, the *'Sushrut Samhita'* delves into the surgical aspects and para-surgical techniques. Among these, noteworthy procedures include the use of corrosive plant alkalies (*Kshar Karma*)[6] and the selective application of heat on specific points (*Agnikarma*)[7] to alleviate pain and inflammatory conditions, extensively detailed within the text.

Modern scientific advancements have unveiled the pivotal role of neurotransmitters in managing not only the functions of the nervous system but also in acting as bridges between nerves, muscles, and joints, essentially forming the neuro-musculo-skeletal system.[8] They indirectly influence the mechanism of inflammation in various bodily systems. Drawing inspiration from wisdom found in *Ayurveda*, Homeopathy, Chinese medicine, modern medicine, and other related sub-systems, Dr. (Vaidya) Prerak Shah envisioned a novel therapeutic approach. He proposed blending insights from these diverse disciplines to design a new treatment modality for inflammatory conditions impacting various tissues and, subsequently, musculo-skeletal functions.

After years of dedicated research and clinical practice, Dr. (*Vaidya*) Prerak Shah successfully developed a groundbreaking Ayurvedic treatment called "Arthrothermia®" (patented) for osteoarthritis (OA). Arthrothermia® is firmly rooted in the principles of *Kshar Karma* and *Agnikarma,* as elucidated in the *Sushrut Samhita*. In our daily clinical practice, Arthrothermia® has emerged as a promising therapeutic method, yielding remarkable results for numerous OA patients.

Arthrothermia®, the brainchild of Dr. Prerak Shah, presents a highly promising avenue for managing OA and neuro-muscular disorders. It combines the ancient techniques of alkaline cautery and micro thermal cautery, namely *Kshar Karma* and *Agnikarma.* These treatments, as described by *Acharya Sushruta*, are ancillary surgeries (non-invasive and bloodless procedures)[9] recommended when major surgeries are not viable[10] Arthrothermia® seamlessly melds the therapeutic power of *Agnikarma* and *Kshar Karma,* forming a scientific and effective solution for OA.

Kshar Karma, another integral aspect of *Ayurvedic* surgical interventions, employs medicated alkaline substances ("*Ksharas*") to treat various diseases. These substances, derived from plants and minerals, are meticulously prepared.[11] *Kshar Karma* involves the precise application of these substances to targeted areas to eliminate diseased tissues and promote healing.[12] It is commonly employed for anorectal disorders, sinusitis, fistulas, and specific skin conditions.[13]

Agnikarma, a time-honored *Ayurvedic* therapy, employs heat or thermal energy applied to specific points to alleviate musculoskeletal disorders.[14] It enhances blood circulation, relaxes muscles and tissues, reduces inflammation, and promotes tissue regeneration.[15] *Agnikarma* finds application in managing conditions such as arthritis, joint pain, muscle sprains, and chronic pain.[16]

With the combined benefits of *Agnikarma* and *Kshar Karma*, Arthrothermia® emerges as a promising

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therapy, providing non-invasive, targeted relief for OA and related neuro-muscular disorders. By combining alkaline cautery with controlled heat therapy directly to affected joints, Arthrothermia® aims to reduce pain, enhance joint function, and alleviate inflammation. Although the use of Arthrothermia® for OA management is a relatively recent development, its potential and underlying mechanisms are being actively explored. Unravelling the impact of Arthrothermia® on OA could significantly improve the quality of life for those grappling with this challenging condition. Our previous data on effect of Arthrothermia® on narrowing the AP diameter of lumbar discs shows great promise.[17]

Kshar Karma, an integral facet of *Ayurvedic* surgical practices, represents a distinctive and age-old therapeutic procedure employing medicated alkaline substances known as "*Ksharas*" to address a range of diseases and conditions.[18] Rooted in the *Sanskrit* words "*Kshar*," signifying alkaline, and "*Karma*," denoting action, *Kshar Karma* can be characterized as the "alkaline therapy" in *Ayurveda*. With centuries of practice within *Ayurveda*, *Kshar Karma* revolves around harnessing the potent properties of alkaline substances to eliminate diseased tissues and foster healing within the body.[19] The alkaline components utilized in *Kshar Karma* are sourced from diverse plant and mineral origins and undergo a meticulous preparation process.[20] This therapeutic approach involves the precise application of medicated alkaline substances to specific afflicted areas[21], whether for the treatment of hemorrhoids or the management of sinus-related disorders.[22] The alkaline agents function by orchestrating controlled chemical cauterization, dissolving afflicted tissues, and encouraging the regeneration of healthy tissue. *Kshar Karma* is widely recognized for its effectiveness in delivering enduring relief while diminishing the likelihood of recurrences.[23]

In modern times, alkaline cautery, known as chemical cautery or chemical cauterization, is a medical procedure involving the application of alkaline substances to cauterize or eliminate unwanted tissue. It finds utility in various medical domains, including dermatology, ophthalmology, and otolaryngology. The central objective of alkaline cautery is the removal or treatment of specific lesions, such as warts and skin tags, through the chemical burning or dissolution of targeted tissue, culminating in its eradication or resolution.[24]

Alkaline substances frequently employed for cautery encompass silver nitrate, trichloroacetic acid, and hydroxides.[25] Alkaline cautery boasts several advantages, chief among them being its simplicity and ease of execution. This outpatient procedure is relatively swift and can be conducted within a clinical setting. In comparison to more invasive surgical techniques like excision or cryotherapy, alkaline cautery is often less invasive, rendering it suitable for individuals averse to extensive surgery.[26]

Additionally, alkaline cautery proves cost-effective in contrast to surgical interventions, enhancing accessibility for a broader spectrum of patients. Furthermore, recovery periods following alkaline cautery are typically shorter, entailing minimal scarring or tissue damage.[27] Nevertheless, it is imperative to acknowledge the limitations of alkaline cautery. Not all types of lesions or deeper tissue involvement are suitable for this procedure. There exists a potential risk of complications, including infection, scarring, or excessive tissue destruction, if the procedure is not performed accurately or in appropriate cases. Consequently, it is essential for healthcare professionals to meticulously assess the suitability and potential risks of alkaline cautery for each individual patient.

In summation, alkaline cautery serves as a valuable and frequently employed technique for the removal or treatment of specific lesions. Its merits encompass simplicity, cost-effectiveness, and minimal invasiveness. Nonetheless, the prudent evaluation and selection of patients are indispensable to ensure optimal outcomes and the mitigation of complications.

Agnikarma, also known as Thermal Cautery, stands as a well-established para-surgical intervention within the Ayurvedic domain. When executed correctly, it poses minimal risk of complications and has garnered

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substantiated effectiveness within Ayurvedic literature.[28] The term "*Agnikarma*" translates to the application of *Agni*, signifying heat. This ancient medical technique, derived from Ayurveda, has been meticulously crafted to alleviate various muscular and joint disorders. *Agnikarma* involves the transfer of heat to afflicted body parts using aseptically prepared metal *Shalaka* (metal rods).[29] These metal rods facilitate the creation of therapeutic burns, employing specialized knowledge in the assessment of the disorder type, the patient's constitution, the disorder's severity, and more. *Sushruta,* a prominent Ayurvedic authority, has extensively expounded on *Agnikarma's* efficacy in addressing issues related to *Asthi* (bone), *Sandhi* (joint), and *Snayu* (ligament/tendon).[30] *Agnikarma* proves effective in both acute and chronic pain conditions, encompassing ailments such as knee pain, back pain, sciatica, lumbago, lumbar spondylosis, slipped discs, neck pain, cervical spondylosis, osteoarthritis, tennis elbow, carpal tunnel syndrome (CTS), heel pain, plantar fasciitis, myofascial pain, chronic fatigue pain, tendonitis, frozen shoulder, migraines, and more.[31] Remarkably, diseases treated with *Agnikarma* are believed to be free from recurrence and the associated fears of purification and bleeding.[32] This therapeutic approach is acclaimed for its ability to balance vitiated *Vata Dosha*, a pivotal factor in pain and pathological decomposition.

Classical *Agnikarma* emerges as a highly dependable procedure when compared to invasive surgical interventions or oral medications. It offers enhanced effectiveness and diminishes the chances of disease recurrence. The risk of infection is minimal when correctly performed, and it is relatively free from secondary complications. *Agnikarma* also proves beneficial in pain relief for numerous musculoskeletal disorders, the healing of chronic stubborn ulcers, and the treatment of conditions such as cysts, hemorrhoids, fistulae, benign tumors, filarial swellings of legs, elevated moles, and even as a hemostyptic in severe bleeding conditions.

In modern times, Thermal cautery, known as thermal coagulation or thermal ablation, is a medical procedure that harnesses heat to destroy or excise tissue. This approach involves the precise application of controlled heat to a designated area, typically through a heated instrument like a cautery pen or probe. With diverse applications across medical specialties, thermal cautery offers numerous advantages.

In surgical settings, thermal cautery serves as a vital tool for cutting or coagulating tissue during procedures, facilitating blood control and achieving hemostasis. The heat generated by the cautery device effectively seals blood vessels, reducing the risk of excessive bleeding. Dermatology utilizes thermal cautery for the removal of unwanted skin lesions, including warts, moles, skin tags, and small tumors. This minimally invasive technique, known for its precision, minimal scarring, and reduced infection risk, is often preferred over conventional excision methods.[33]

The simplicity and cost-effectiveness of thermal cautery are noteworthy advantages. It is a relatively quick procedure suitable for outpatient settings, reducing the need for extended hospital stays. This method also minimizes complications typically associated with traditional surgical techniques.[34] Notably, thermal cautery allows for targeted treatment. The heat can be precisely directed to the intended area, minimizing harm to healthy tissue. This precision preserves form and function while achieving the desired therapeutic outcomes.

In summary, thermal cautery emerges as a versatile procedure with a broad spectrum of uses and associated benefits. It provides an effective means of tissue destruction or removal while minimizing complications and promoting optimal healing.

The present study documents systematic scientific data of 30 patients with OA who underwent Arthrothermia® treatment and acquired magnificent benefits of the novel Ayurvedic treatment for OA.

Materials and Methods

The study enrolled 30 patients who were diagnosed with OA. Informed consent was obtained from all the patients who underwent Arthrothermia® treatment.

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Subjects:

30 subjects with complaints of severe knee pain were enrolled from OPD of Ayulink Ayurveda for this study. The patients complained of increasing and unbearable pain while sitting, over standing and walking (*Janu-Sandhi Shula*). The study included both male (n=11) and female (n=19) subjects. The age range was 30-40 years (n=2), 41-60 years (n=10) and above 60 years (n=18).

Selection Criteria

The study included patients above 30 years. The general health condition of all the patients was good. The patients with severe chronic knee pain were enrolled. All the patients enrolled for the study were having confirmed diagnosis of OA with radiographic investigation (x-ray). The crepitation was +ve (> + 2) on clinical examination. The patients had history of receiving allopathy treatment with no or minimal relief.

Arthrothermia® treatment

Each subject was given Arthrothermia® treatment for 6 sittings in 6 days. The treatment plan included Pre tretment process and Main procedure, and post-treatment procedures, which comprise of application of herbal *Kshar* (alkali made out of herbal substance) i.e., *Kshar Karma* and application of heat i.e., *Agnikarma* (indirect micro-thermal cautery) with suggested interval. All data of pre and post treatment, B.P. and Pulse were noted in treatment record form.

Assessment Criteria for outcome of Arthrothermia® treatment

As criterion of assessment, it was decided to use the Knee injury and Osteoarthritis Outcome Score (KOOS). The KOOS is developed as an extension of the WOMAC OA Index with the purpose of evaluating short-term and long-term symptoms and function in subjects with knee injury and OA.[35]

Statistical Analysis

The statistical analysis of the data obtained from KOOS was done using statistical SPSS (Version 19) software. Student's t-test (unpaired and paired) was used as the statistical endpoint.

RESULTS

The present study obtained socio-demographic data, clinical details and scientific data of 30 patients with OA who underwent Arthrothermia® treatment. The outcome of Arthrothermia® treatment was scientifically examined using KOOS. The KOOS was obtained from five separately scored subscales: Pain, other Symptoms, Function in daily living (ADL), Function in Sport and Recreation (Sport/Rec), and knee-related Quality of Life (QOL). The KOOS data of the 30 patients for pre- Arthrothermia and post-Arthrothermia were compared using paired 't' test.

Figure 1: KOOS data: Comparison (Mean +/- S.E.) between pre-Arthrothermia® and post-Arthrothermia®

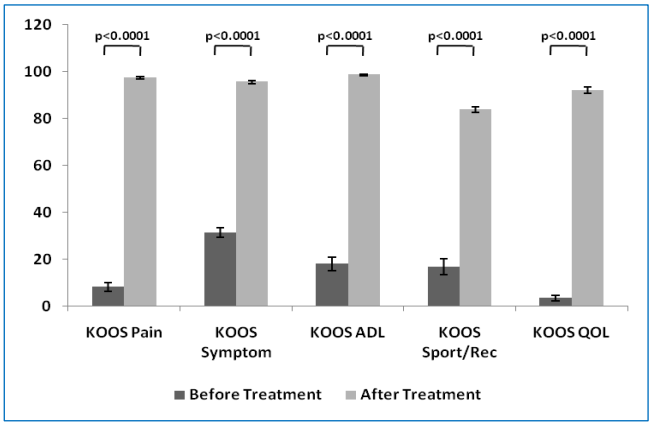

Figure-1 documents comparison of KOOS (Mean+/- S.E.) data between pre-Arthrothermia® and post-Arthrothermia® for 30 patients. The KOOSQOL was lowest before Thus, after receiving Arthrothermia® treatment, significant improvement in every KOOS sub score is evident in patients (p<0.0001).

Table 1: KOOS data: Paired t-test analysis for comparison between pre-Arthrothermia® and post-Arthrothermia® for each indicator individually in 30 patients.

	Mean	S.E.	'p' value
KOOS Pain			
Before Treatment	8.23	1.89	<0.0001
After Treatment	97.13	0.516	

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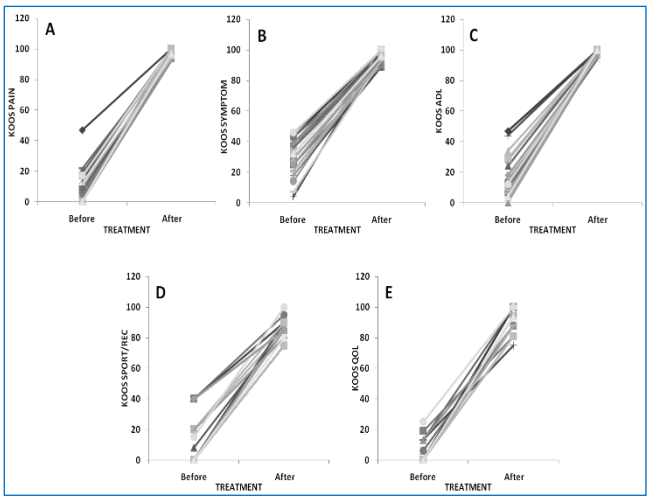
KOOS Symptom			
Before Treatment	31.3	1.995	<0.0001
After Treatment	95.43	0.608	
KOOS ADL			
Before Treatment	17.86	2.842	<0.0001
After Treatment	98.53	0.283	
KOOS Sport/Rec			
Before Treatment	16.77	3.297	<0.0001
After Treatment	83.67	1.221	
KOOS QOL			
Before Treatment	3.37	1.204	<0.0001
After Treatment	92	1.412	

Table-1 shows paired t-test analysis for comparison between pre-Arthrothermia® and post-Arthrothermia® for each indicator individually in 30 patients. The mean score of pre-Arthrothermia® for KOOS Pain, KOOS Symptoms, KOOS ADL, KOOS Sport/Rec and KOOS QOL were 8.23, 31.3, 17.86, 16.77 and 3.37, respectively. Whereas, the post-Arthrothermia® for KOOS Pain, KOOS Symptoms, KOOS ADL, KOOS Sport/Rec and KOOS QOL were 97.13, 95.43, 98.53, 83.67 and 92, respectively. The increase in the KOOS data were highly significant ($p<0.001$) in each patient individually also when compared between before-Arthrothermia® and after-Arthrothermia®.

Figure-2 exhibits individual values of all five KOOS sub scores at pre-Arthrothermia® and post-Arthrothermia® for 30 patients. At pre-Arthrothermia® KOOS pain ranged from 0 to 47, KOOS Symptoms ranged from 4 to 46, KOOS ADL ranged from 0 to 47, KOOS Sport/Rec ranged from 0 to 40, and KOOS QOL ranged from 0 to 25. At post-Arthrothermia® KOOS pain ranged from 92 to 100, KOOS Symptoms ranged from 89 to 100, KOOS ADL ranged from 94 to 100, KOOS Sport/Rec ranged from 75 to 100, and KOOS QOL ranged from 75 to 100. Hence, on an average, there was 2 to 10 fold increase in the KOOS data after-Arthrothermia®. Further, it was observed that the Arthrothermia® treatment showed better results for KOOS Sport/Rec and KOOS QOL as compared to that for KOOS Pain, KOOS Symptoms and KOOS ADL.

Figure 2: KOOS data: Comparison between pre-Arthrothermia® and post-Arthrothermia® for each indicator in 30 patients.



The KOOS data were further categorised according to age (>40 years, 40-60 years, and >60 years) and gender (male and female) and the comparison was made using paired 't' test for pre- Arthrothermia® and post-Arthrothermia®. As only two patients were in the age group >40 years, it was omitted from the statistical analysis. Figure-3 (A and B) and Figure-4 (A and B) illustrates comparison data for age and gender groups, respectively. Comparisons for both the groups demonstrated significant and comparable improvement in every KOOS sub score ($p<0.0001$).

After categorization, separate analysis was performed for pre-treatment valuables as per age and gender using independent 't' test. On analysis, it was noted that KOOS ADL was significantly ($p=0.024$) higher in patients with age >60 years (22.94±4.05) than patients with age 40-60 years (11.1±2.83). All other pre-treatment valuables were almost identical and with no significant difference between age and gender groups (data not shown). Likewise independent 't' test was employed for post-treatment KOOS sub score analysis according to age and gender and none of the post-treatment KOOS sub scores showed significant

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difference between the age and gender groups (data not shown).

Figure 3: KOOS data: Comparison (Mean +/- S.E.) between pre-Arthrothermia® and post-Arthrothermia® as per age groups: a) patients with 40-60 years and b) patients with >60 years.

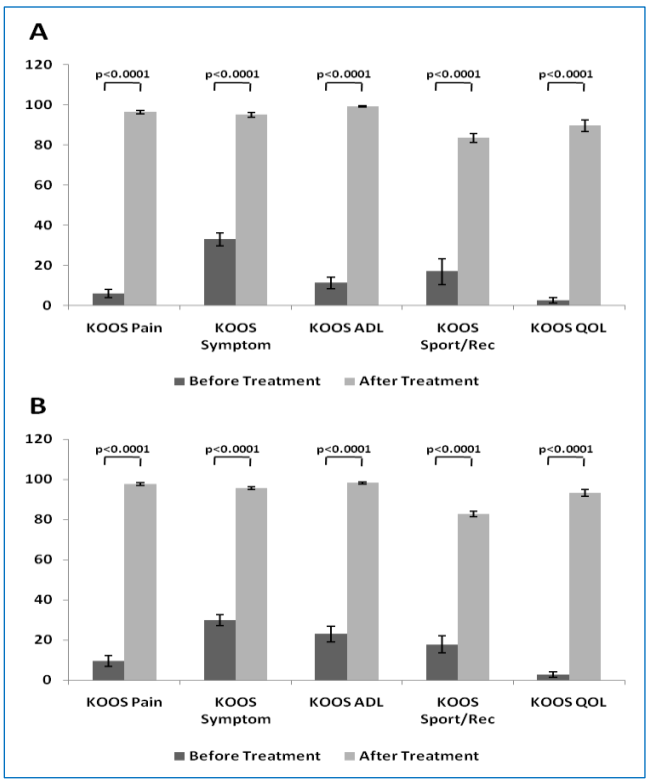
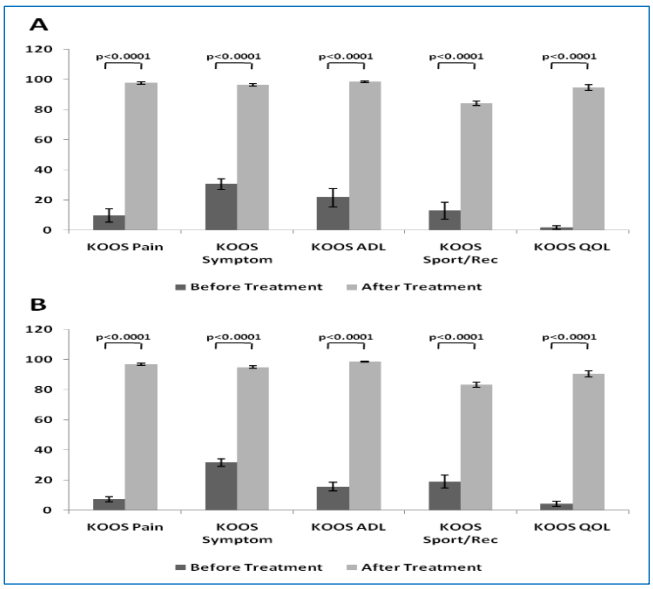


Figure 4: KOOS data: Comparison (Mean +/- S.E.) between pre-Arthrothermia® and post-Arthrothermia® as per age groups: a) male patients and b) female patients.



DISCUSSION

Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India.[36] It is projected that the number of OA patients in world could reach approximately 1200 million by the year 2050, there will be an estimated 642 million (95% UI 574–722) individuals with knee osteoarthritis, 279 million (221–338) individuals with hand osteoarthritis, 62·6 million (49·7–75·5) individuals with hip osteoarthritis, and 118 million (97·1–144) individuals with other types of osteoarthritis.[37]

This substantial increase highlights the urgent need for effective management and prevention strategies to mitigate the burden of OA on individuals and healthcare systems in the country.[38] Among various opportunities to address health issues of patients suffering with OA, Ayurveda is an important ancient promising alternative medicine which should explored to establish its worth to treat OA; the stern health hazard worldwide.

Arthothermia®, being a novel treatment approach, the data obtained by the treatment should be scientifically authenticated by appropriate tools. Hence, we used three tools; SKOOS, Student's unpaired t-test and Student's paired t-test.[39] KOOS is a validated questionnaire used to assess the subjective outcomes and symptoms of individuals with knee injuries or OA. The KOOS questionnaire consists of several subscales, including pain, symptoms, and activities of daily living, sport/recreation function, and knee-related quality of life. It is commonly used in clinical research and practice to evaluate the effectiveness of interventions and treatments for knee-related conditions. It is a validated questionnaire used to assess the subjective outcomes and symptoms of individuals with knee injuries or OA. The KOOS holds five separately scored subscales: Pain, other Symptoms, Function in daily living (ADL), Function in Sport and Recreation (Sport/Rec), and knee-related Quality of Life (QOL).[40] The KOOS has been validated internationally for several orthopaedic interventions such as anterior cruciate ligament reconstruction,[41] meniscectomy

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and total knee replacement. It is documented that, KOOS is a valid, reliable and responsive self-administered instrument that can be used for short-term and long-term follow-up of several types of knee injury including osteoarthritis.[42] In addition, KOOS has been used to evaluate physical therapy, nutritional supplementation and glucosamine supplementation also. Based on the Present investigation found that there was a significant improvement using KOOS data.

Mode of action (Hypothesis)

The mode of action according to Ayurveda involves the amalgamation of *Kshar Karma* and *Agnikarma* processes, combining the use of herbal chemicals and mechanical heat for therapeutic purposes in a precise manner. Ayurveda posits that when provoked *Vayu*, a vital element in the body, lodges itself in *Asthi-Sandhi-Sira-Snayu* (bones, joints, blood vessels, and ligaments), it results in pain and stiffness.[43] Therefore, the primary objective of treatment is to remove *Vayu* from that specific site. *Vayu* is inherently cold in nature. The heat provided by the Arthrothermia® procedure, owing to its *Ushna Guna* (hot property), pacifies the *Sheeta Guna* (cold property) of *Vayu* and eliminates it from the affected area.[44] This expulsion of *Vayu* from the afflicted site results in pain relief for the patient.

From a modern perspective, skeletal muscles are closely associated with bones, constituting the skeletal system. These muscles make up a substantial portion of body mass (40-50%) and function as voluntary muscles supplied by somatic nerves. Skeletal muscles possess multiple nuclei, myofibrils, sarcomeres, and troponin. The sarcotubular system is well developed in these muscles. Muscle contraction is initiated by the depolarization that occurs upon stimulation. This process involves the binding of calcium with troponin, and the source of calcium is primarily the sarcoplasmic reticulum. Muscles control neurogenic actions, and the neuromuscular junction is well-defined. Muscle contraction can be induced by various types of stimuli, including mechanical, thermal, and chemical stimuli. Each stimulus type has its unique qualities, including intensity, duration, and the physiological changes it induces.[45]

During muscular contraction, several changes occur, including electrical changes related to depolarization and repolarization. These changes are driven by ionic events such as the sodium-potassium pump and selective permeability of the cell membrane. Physical changes involve alterations in the length and tension of muscles during isotonic and isometric contractions. Histological (molecular) changes encompass the excitation-contraction coupling, the role of troponin and tropomyosin, and the sliding mechanism.[46]

Chemical changes include the breakdown of ATP (adenosine triphosphate) to liberate energy during muscle contraction. This process is accelerated by thermal stimuli. Resynthesis of ATP occurs through carbohydrate metabolism, glycolysis, the Cori cycle, and the Krebs cycle. Thermal changes are also a part of the process, with heat production facilitating the availability of oxygen, nutrients, the formation of acetylcholine at the neuromuscular junction, removal of metabolites, and the re-establishment of the normal polarized state of muscle. This leads to the relaxation of muscle, tendons, and ligaments, relieving stiffness.[47-48]

Neuromuscular transmission involves the release of acetylcholine, its action, the development of endplate potential, the development of miniature endplate potential, and the destruction of acetylcholine. These events culminate in the stimulation of the neuromuscular junction, acetylcholine secretion, and muscle contraction and relaxation.

In summary, the modern view of the mode of action delves into the intricate physiological and biochemical processes involved in muscle contraction and relaxation, highlighting the role of various stimuli and their impact on muscle function.

CONCLUSION

The present case study revealed that the "Arthrothermia®" - a unique Ayurveda treatment approach (combination of alkaline cautery and indirect micro thermal cautery) has shown significant changes in very short time duration, in Osteoarthritis (knee pain).

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The findings from this study, which assessed the individual values of all five KOOS (Knee injury and Osteoarthritis Outcome Score) sub-scores before and after Arthrothermia® treatment for 30 patients, reveal significant improvements in knee-related quality of life. The pre-Arthrothermia® scores for each sub-score varied, with some patients experiencing substantial limitations in pain, symptoms, activities of daily living, and sports/recreation participation. However, post-Arthrothermia® scores demonstrated remarkable enhancements, indicating a substantial increase in knee function and overall well-being.

1. **Substantial Improvement:** There was a noteworthy increase in all KOOS sub-scores after Arthrothermia® treatment, with an average of 2 to 10 time's higher scores across the board. This indicates that the treatment had a profound and positive impact on the patients' knee health and function.

2. **Consistent Improvement:** While there were variations in the pre-Arthrothermia® scores, the post-treatment scores consistently demonstrated marked improvement. This suggests that Arthrothermia® had a consistent positive effect on the patients, regardless of their initial condition.

3. **Superior Results for Sport/Recreation and Quality of Life:** Arthrothermia® treatment yielded particularly impressive results for the KOOS Sport/Recreation and KOOS Quality of Life sub-scores, with many patients achieving scores close to or at the maximum of 100. This implies that patients experienced significant improvements in their ability to engage in sports and recreational activities, as well as their overall quality of life.

4. **Varied Responses in Pain and Symptoms:** While the improvement in KOOS Pain and KOOS Symptoms was substantial, it was not as pronounced as that in the Sport/Recreation and Quality of Life categories. This suggests that some patients may still experience residual pain and symptoms despite overall improvements in knee function.

In conclusion, the findings indicate that Arthrothermia® treatment has the potential to significantly enhance the quality of life for patients suffering from knee-related issues, particularly in terms of their ability to engage in sports and recreational activities. However, it's important to note that individual responses may vary, and some patients may experience a greater reduction in pain and symptoms compared to others. These results underscore the potential benefits of Arthrothermia® as a viable treatment option for improving knee function and overall well-being.

Acknowledgements

We extend our heartfelt gratitude to all those who played a pivotal role in the successful completion of this scientific endeavor on Arthrothermia. This research on Ayurvedic treatment modality stands as a testament to the collaborative efforts and support from well-known allopathic doctors.

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