

Management of Advanced Stage Osteoarthritis of Knee: Efficacy of Integrated Physical Therapy Treatment

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Abstract:

Osteoarthritis (OA) of knee is a major musculoskeletal problem which almost every physical therapist encounters during his or her daily practice. The emphasizes of this study is to find out the efficacy of integrated physical therapy interventions for the management of osteoarthritis knee disease at advance stages (Grade IV).The patient presented in this case study is a 85 year old, an obese male with OA symptoms in bilateral knees. Physical examinations revealed characteristic signs of advanced osteoarthritic disease in both knee with resting pain 8/10 on visual analog scale (VAS) and activity of daily livings (ADLs) were severely restricted. Physical therapy Treatment was designed with integrated protocol consisting of acupuncture treatment with physical therapy interventions using combined approach to control symptoms. After 6 week, the patient demonstrated considerable improvement in all outcome measures: pain, stiffness, tenderness, basic ADLs except advanced functional activities (IADLS). The patient maintained the improved condition in 12 week follows up through advised exercises plan and life style modification strategies.

Keywords: Advanced OA knee, Acupuncture, Chronic Pain Management, Physical Therapy Treatment

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Introduction:

Osteoarthritis (OA), also known as degenerative joint disease, is a progressive deteriorated disorder of synovial joints that results in loss of hyaline cartilage and remodeling of surrounding bone over the time. There is loss of hyaline cartilage, typically at the point of maximum load bearing¹. Osteophyte formation (abnormal outgrowth of cartilage that becomes ossified) occurs at the joint margins and cysts may develop in the bone as disease progresses. Doherty et al² suggest that cysts are small areas of osteonecrosis caused by increased pressure in the bone when the cartilage is no longer adequate in its load-distributing function. Other pathological changes include subchondral sclerosis, thickening of the capsule and evidence of osteochondral bodies in the synovium¹. Degenerative joint diseases (DJD) affect the thixotropic properties (thixotropy is the property of various gels becoming fluid when disturbed, as by shaking) of synovial fluid, resulting in reduced lubrication and subsequent wear of the articular cartilage and joint surfaces^{3,4}

The increase in the incidence and prevalence of OA with age is likely a consequence of several biologic changes that occur with aging, including⁵:

- A decreased responsiveness of chondrocytes to growth factors that stimulate repair.
- An increase in the laxity of ligaments around the joints, making older joints relatively unstable and, therefore, more susceptible to injury.

Kellgren and Lawrence⁶ defined a widely utilized grading system for radiographic evidence of knee OA.

- Grade 1: doubtful narrowing of joint space and possible osteophytic lipping
- Grade 2: definite osteophytes, definite narrowing of joint space
- Grade 3: moderate multiple osteophytes, definite narrowing of joint space, some sclerosis and possible deformity of bone contour
- Grade 4: large osteophytes marked narrowing of joint space, severe sclerosis and definite deformity of bone contour.

The symptoms of this chronic disease are pain, stiffness and potentially reduced function of affected joints. In OA knee at advanced stage the ability to engage in functional and social activities may be restricted depending upon severity of disease and, as a consequence, quality of life may be affected. Pain and stiffness

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with restricted mobility are the main symptoms.

Clinical features of advanced OA include⁷:

- Resting Pain
- Painful Crepitus (a creaking, crunching, grinding sensation on moving the joint).
- Moderate to severe synovitis.
- Severely reduced in range of movement.
- Limited functional activities.

Restricted movement of the joint can occur due to pain, capsular thickening or the presence of osteophytes¹. Crepitus may be noticeable on movement due to the rough articular surfaces and the joint line or periarticular area may be painful on palpation. Pain can be caused directly by increased pressure in the subchondral bone, trabecular micro-fractures or capsular distension which may occur as a result of bursitis (inflammation of the bursa) or enthesopathy (inflammation of the ligament and muscle attachments to the bone). Reduced muscle strength or wasting of the muscles may be evident in severe OA due to lack of use or reduced function of the joint.

Diagnosis is usually based on history and examination. Invasive procedures like pain management techniques and orthopedic

intervention are effectively beneficial in the long term management of advanced OA of knee⁸. Conservative management includes corticosteroid injections, physical therapy/exercises, bracing, walking aids, life style modifications, weight reduction and medications⁹. Management strategies are considered in relation to the person's quality of life, functional limitations and pain experienced. The main focus of interventional strategy is to control pain and improve range of motion (ROM) to enhance functional outcomes. The evidence in literature supports acupuncture as an effective measure to reduce pain and the importance of manual therapy and exercises to improve ROM is well recognized⁸. These available evidences were the main incentive to use integrated physical therapy interventional approach for pain management and improve functions respectively. Systemic reviews conclude that acupuncture is more effective than placebo for osteoarthritis of knee in addition to exercise and life style modifications^{10,11}.

Chronic nociceptive pain of somatic type is the most common determinant for a patient to seek intervention in case of DJD problem⁵. It has been documented in literature that Somatic or Musculoskeletal pain can be generated by:

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- Convergence of sensory input from separate parts of the body to the same dorsal horn neuron via primary sensory fibers (convergence-projection theory)¹²
- Secondary pain resulting from a myofascial trigger point¹³
- Sympathetic activity elicited by a spinal reflex¹⁴
- Pain-generating substances¹²

Pain associated with OA is typically described as dull, aching or throbbing and localized to a specific region¹⁵. The common free nerve endings have two distinct pathways into the central nervous system, which correspond to the two different types of pain represented by two distinct nerve pain pathways: fast conducting A delta and slow conducting C fibers. A-delta fibers evoke a rapid, sharp, lancinating pain reaction; C fibers cause a slow, dull, crawling pain¹⁶.

The symptoms of chronic pain typically behave in a mechanical fashion, in that they are provoked by activity or repeated movements and reduced with rest or a movement in the opposite direction⁵. Nociceptor stimulation can occur with Mechanical deformation. The mechanical cause of constant pain is less understood, but is thought to be the result of the

deformation of collagen, which compresses or stretches the nociceptive free nerve endings, with the excessive forces being perceived as pain¹⁷. Thus, specific movements or positions should influence pain of a mechanical nature in other words pain of mechanical origin is continuous with specific postures or movement patterns.

Acupuncture is reported to be a sensory stimulation by inserting needle into skin which produce afferent response pattern in peripheral nerves by activating “A” delta fibers (causing heaviness and distension), “A” gamma fibers (causing numbness) and “C” fibers causing soreness¹⁸. This whole afferent response is contributor of classic post session sensation of “DeQi”. After needling “A” delta fibers activate mechanoreceptors, the input travels to brain to release Opioids mainly enkephalin, which in action suppresses the transmission of “C” fibers (reduce soreness). It seems to improve function and pain relief as an adjunct therapy for osteoarthritis of knee compare with control group with just education about modification in life style¹⁹.

Case Presentation

Clinical Examination

The patient was 85 year old male with weight just over 90 kg .The patient referred for physical therapy by an

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orthopedic surgeon after finding him unsuitable for any invasive procedure because of his relevant medical problems. He was diagnosed as Grade 4 severe arthritis of both knees with history of diabetes, hypertension and stage 3 renal diseases. The Patient was on pain killers for last 12 years with having history of more than 30 years of knee pain. The symptoms were exacerbating since a year time with no sign of relief. The patient was a retired school teacher and gave statement that he was in habit of standing about 6-8 hours for more than 40 years in his life. Clinical examination revealed bilateral knee pain and tenderness over the medial joint lines, medial and lateral patellar facets & patellar ligaments, more on left than right. There was severe pain on anterior and medial aspect of both knees and generalized pain along the lateral aspect of left thigh. Pain was very intense with rating of 8/10 at rest in both knees on visual analog scale (VAS) which is a 10-cm line ranging from zero (no pain) to 10 (most pain).

Range of motion was painful and restricted at both joints with no tolerance to weight bearing. Patient was very limited in his mobility and completely dependent for his ADLs performance. Clinical findings indicated patellofemoral dysfunction associated with degenerated joint disease

(DJD) of the both knees. Radiographic findings indicated severe osteoarthritis with bilateral decreased joint space & flattening of weight bearing aspect of both joints. A physical therapy diagnosis was made with label of impaired joint mobility, motor function, muscle performance, and ROM associated with bilateral DJD.

Interventions

It has been documented that Indoor physical activity at home in older adults who have difficulty in performing outdoor activities is a key to documenting baseline physical activity levels to guide physical activity intervention outcome aimed at reducing the rate of decline in mobility²⁰. In this case, despite of bilateral knee DJD, the age of patient may also have a major role in his functional limitation in both indoor and outdoor mobility in order to perform activities of daily livings.

Activities of daily living (ADLs) are daily self-care activities within an individual's place of residence (indoor), in outdoor environments, or both. The ability or inability to perform ADLs is a measurement of the functional status of a person, particularly in regards to people with disabilities and the elderly²¹. Basic ADLs (BADLs) consist of self-care tasks²² In this case the main areas of our concern is independent bathing and showering capability of patient (washing the body)

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with proper bowel and bladder management (recognizing the need to relieve oneself), ability of self dressing and functional mobility (moving from one place to another while performing activities) while Instrumental activities of daily living (IADLs) are not necessary for fundamental functioning, but they let an individual live independently in a community²³ and the focus of our goals is housework, shopping for groceries or clothing and transportation within the community.

The patient interviewed to determine his priorities and desired outcomes of treatment. The main goal determined was the control of Resting Pain and management of basic ADLS. The interventional plan of care designed with acupuncture treatment session integrated with physical therapy interventions to achieve this goal. The 6 weeks plan of care consisting of 15 physical therapy sessions designed with aim to address the condition. The patient was informed and obtained consent for use of needles and manual procedures. In the first 2 weeks treatment was given on alternate day basis and the main emphasize was on acupuncture treatment and pain inhibiting manual therapy interventions. In the first 2 sessions acupuncture treatment was given with joint traction maneuver. In third

sessions, passive stretching to hip flexors and calf muscles was added in treatment. In third session mobilization with movement techniques for patellofemoral joint was added along with hamstring and IT band stretching according to the tolerance of patient. This treatment was continues for another 3 sessions. A reevaluation was made after 2 weeks and decided to continue same rehabilitation plan for another two weeks with addition of exercises plan and reducing in the frequency of treatment to twice a week sessions. After 10 sessions (4 weeks), acupuncture treatment was withdrawn and rest of treatment continued for another 4 sessions over next 2 weeks (Total 6 weeks).

Reasoning For Acupuncture

Point Selection:

Current evidence demonstrated that acupuncture is likely to provide replacement of Non Steroidal Anti Inflammatory drugs (NSAIDs), being at least equally effective and probably more cost effective and much safer²⁴. National Institute of Health and Clinical Excellence (NICE) in 2009 recommends considering to offer a therapeutic course of acupuncture treatment comprising up to 10 sessions over a period of 12 weeks²⁵. White et al¹¹ defined acupuncture as adequate if it is consisted of at least 6

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sessions, at least once per week with at least four points for treatment of chronic knee pain. All 4 local knee points were selected according to the best available evidence about their efficacy. Two points stomach meridian points ST35 & ST36 and two spleen meridian points SP9 & SP10 were included in intervention. ST 35 is an intra articular point and is effective local point to treat knee pain⁹. Wu et al,

demonstrated ST36 produce activity in the descending anti-nociceptive pathways and in limbic area associated with pain response²⁶. The points in spleen meridian SP9 & SP10 are effective to control joint pain in the absence of joint effusion and swelling. Effusion makes it difficult to apply the points especially SP9. They are known to be effective in reducing pain and skin hypersensitivity.

Acupuncture	Specific Manual Techniques Used	Active Rehabilitation Protocol
Acupuncture treatment was given at ST 35,36 & SP9,10 with 4mm needles for 15 minutes during each session in first 4 weeks	<ul style="list-style-type: none"> • <i>Passive stretching of the bilateral hip flexors, iliotibial band, hamstrings and gastrocnemius.</i> • <i>Bilateral patellofemoral joint mobilization techniques.</i> • <i>Bilateral MWM technique for patellofemoral joints.</i> • <i>Bilateral tibiofemoral joint traction maneuver.</i> 	Range-of-motion exercises mainly for both knees were performed in the non-weight-bearing position. Exercises include: <ul style="list-style-type: none"> • <i>Isometric quadriceps sets at 20 degrees of flexion, progressing to multiple angle isometrics 20 times each in 3 sets.</i> • <i>Heel slides with the tibia positioned in internal for 10 times and then external rotation for 10 times in 3 sets. Straight leg raises performed with the thigh externally rotated and the knee flexed to 20 degrees 10 times in 2 sets.</i> • <i>Adductors isometrics in crook lying, with pillow between both knees, press and hold for 5 seconds, 20 repetitions in 2 sets.</i> • <i>Bridging exercise, with characteristic lift off bed and hold of pelvis for 5 seconds each in 20 repetitions divided in 3 sets.</i>

Table: 1

Reasoning For Application of Manual Therapy (MT)

Techniques:

MT techniques are used to produce therapeutic benefits in relieving pain and improving soft tissue extensibility through the application of specifically directed external forces^{27,28}. Narrowing of articulating surface of tibiofemoral joint is the main primary pathology involved in

OA knee. Bilateral tibiofemoral joint traction maneuver was introduced as Grade I distraction (Kaltenborn technique) which was administrated as intermittent distraction for 7 to 10 seconds with a few seconds of rest in between for several cycles of repetition²⁹.

Dysfunction at the patellofemoral joint is one of the major reasons for anterior knee pain⁵. Initially, bilateral Grade I & Grade

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II rhythmic oscillations using (Maitland Approach) given to inhibit pain which progressed through session 3 to 5 into Bilateral MWM technique (Mulligan's concept) for patellofemoral joints. Maitland's grades I and II are used solely for pain relief and have no direct mechanical effect on the restricting barrier, although they do have a hydrodynamic effect. Mobilization-induced analgesia has been demonstrated in a number of studies in humans^{30,31} and is characterized by a rapid onset and a specific influence on mechanical nociception. Grade I and II joint mobilizations are theoretically effective in pain reduction by improving joint lubrication and circulation in tissues related to the joint³². Rhythmic joint oscillations also possibly activate articular and skin mechanoreceptors that play a role in pain reduction^{33,34}.

The prolonged immobility of patient rendered him to be present during clinical examination in strength deficient and muscular imbalance pattern. Passive stretching of the bilateral hip flexors, iliotibial band, hamstrings and gastrocnemius and active strengthening protocol of quadriceps included in intervention to correct and target improvement in muscle recruitment patterns during functional tasks.

Outcomes:

After 6 physical therapy home Sessions in a span of 2 weeks, a considerable reduction in bilateral joint pain and tenderness was noted, resting pain level on VAS was 5/10 with slight improvement in basic ADLs. After next 8 sessions, in duration of 4 weeks, there was no resting pain, though it was noted that activity shifts the marker on pain scale to 4/10 but there was moderate increase in basic ADLs capacity. Though instrumental ADLs were not very much affected by physical therapy treatment in this case but physical therapy interventions helped him by eliminating the intense resting pain and consequently improved quality of life. Patient was contacted for follow up inquiry after 12 weeks and patient informed maintained of improved condition through prescribed exercises and adopting measures for modifications in life style.

Discussion

“Integrative therapy is a term which is most commonly used to refer treatment approach in psychotherapy. It is customized therapeutic approach in which several different techniques are used to manage patient's symptoms”³⁵.

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Patient Education

The patient was instructed:

- *To perform isometric quadriceps and bridging exercises 3-5 times daily, and open chain quadriceps exercises with or without weight for at least twice a day.*
- *To avoid sit on low surface.*
- *To avoid prolong standing and walking in any case through rest of life.*
- *To wear knee support before must do prolong weight bearing activities.*
- *To apply prescribed anti inflammatory cream regularly.*

Table: 2

Additionally, in clinical practice, sometime it is mandatory for practitioner to adopt customized interventions that modify standard guidelines and introduce new and more effective management strategies. This approach enables practitioner to develop a program designed specifically for the patient's unique needs, addressing patient's personality and threshold with circumstances and situation rather than providing simple treatment protocols which may seem to be unproductive in terms of outcomes.

This case study attempted to analyze and presented the combined physiotherapy management and acupuncture of a patient complaining of bilateral chronic knee pain. Treatment was decided on pathophysiologic base of pain mechanism with focusing on the chronicity of the disorder and realistic outcomes as restorable functional goals in the environment of his own home. In this study 10 acupuncture sessions were given in 4 weeks. Local points around the knee

were selected for the study and the pattern and duration of needle application was intentionally set unchanged throughout 10 treatment sessions after observing positive outcomes from first application. After the first, the patient reported a mild increase in general pain which lasted around 12 hours. No other adverse side effects were encountered during or after intervention.

The limitation of this study was to use as minimum points for acupuncture treatment as recommended. There is lot more available that could be added in the study for more benefits. Evidence in literature gives reflection that the "four gates" LI4 bilateral (B) and LR3 (B) exhibit a powerful analgesic affect so these points could have been selected initially for a more calming effect and pain modulation³⁶. KI6 (B) or KI9 (B) could have been used for strengthening of the bones due to the osteoarthritis presentation to aim for a stimulation of the kidney systemic effect. Additionally, SP6 (B)

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could have been a good choice to aid reducing the knee inflammation³⁷.

In literature acupuncture has been repeatedly reported to relieve pain associated with osteoarthritis of the knee. It has been shown in studies that Patients with osteoarthritis of the knee appear to experience clinically significant improvements measured in terms of six-minute walking distance, pain relief and mobility when standard care is supplemented with acupuncture³⁸. Acupuncture is not used as treatment option by physiotherapists in Pakistan.

Conclusion

The integration of exercises and patient education through life style modifications in combination with acupuncture has demonstrated good pain management strategy and seems to be helping in achievement of his basic activities of daily living and indoor functional goals. However, the intervention required significant number of sessions in order to continue working towards the achievement of his Instrumental activities of daily livings and outdoor mobility goal. However, these are hard to justify because of the extent of progression of his disease. The question is: how long can we offer

long interventions in order to improve functional mobility in this case?

The practice of Integrative physical therapy in Pakistan with an approach to combine other musculoskeletal treatment options like acupuncture, acupressure and psychotherapeutic measures into a physical therapy program can be very beneficial for the patient. The experience of mixing acupuncture with manual therapy as Physical therapy integrated approach is a positive hope for patients although in this case it has shown effective in pain management with only slight to mild improvement in functional capacities but it is really concerned with improving quality of life.

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